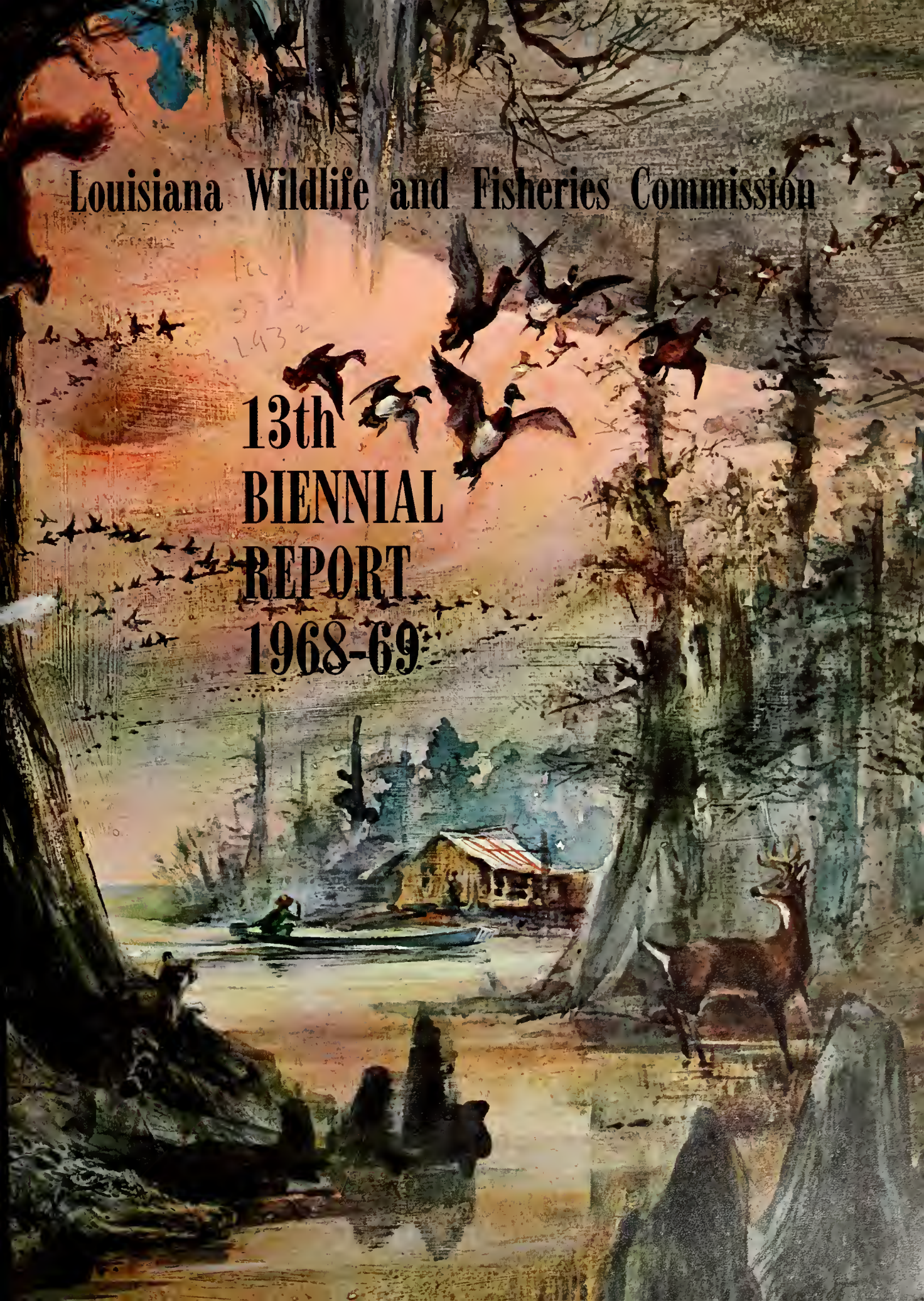




Louisiana Wildlife and Fisheries Commission

13th  
BIENNIAL  
REPORT  
1968-69



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*Louisiana Wild Life  
and Fisheries Commission*

— 13<sup>th</sup> —

*Biennial  
Report*

1968 / 1969

Published by

LOUISIANA WILD LIFE AND  
FISHERIES COMMISSION

WILD LIFE AND FISHERIES BUILDING  
400 ROYAL STREET  
NEW ORLEANS, LOUISIANA 70130

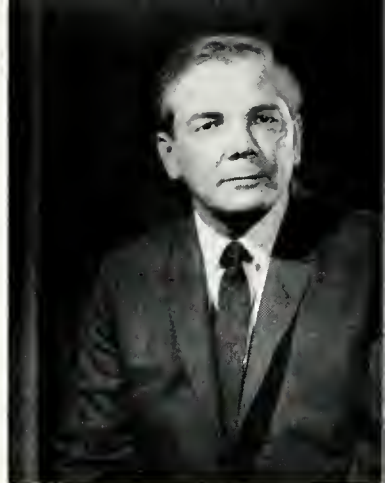


JOHN J. McKEITHEN  
GOVERNOR

## State of Louisiana

EXECUTIVE DEPARTMENT

Baton Rouge



### *Citizens of Louisiana*

The period covered by this two-year report was one marked with accelerated work by the Louisiana Wild Life and Fisheries Commission to manage and enhance wildlife and fisheries resources which play such an important role in both the economic and recreational progress of the State of Louisiana.

The value of proper wildlife and environmental management has never been accorded the recognition that it has today. We are entering a decade when local, regional and national attention will be focused upon the proper stewardship of our fish and wildlife resources—our natural resources of forests, waters, minerals and air.

We have long recognized the importance of hunting and fishing, particularly at a time when a virtual population explosion is taking place, one that finds more and more people with leisure time on their hands and a mounting inclination to seek outdoor recreation hunting, fishing, camping, hiking, boating and in related forms of sport.

This welling desire for outdoor recreation, manifested not only in active participation but also in obvious interest by the public in the welfare of natural resources, comes at a time when increasing demands are being made by industry for land, water and basic resources.

We are also faced with new demands for land and water to be utilized in expanding agricultural uses. These demands for land and water by industry and agriculture come at a time when the Louisiana Wild Life and Fisheries Commission must also acquire additional woodland and marshland if public hunting and fishing for future generations is to be assured.

As custodians of wildlife and fisheries resources, the Louisiana Wild Life and Fisheries Commission sets the management policy for multi-million dollar fisheries and fur resources. The economic value of these industries is known in every part of the state. Unfortunately, there is no dollar value on wildlife resources at a recreational level. Conservative estimates would place this at several hundreds of millions of dollars annually.

The Louisiana Wild Life and Fisheries Commission is the hub around which revolves all major state efforts to abate pollution and preserve Louisiana's natural resources and environment. This responsibility will be tripled in the immediate years ahead.

Just how important this stewardship is will be found in the pages of this report. In setting forth the accomplishments of the past two years, the Louisiana Wild Life and Fisheries Commission also charts a course of action for the future

*John J. McKeithen*

# State of Louisiana



WILD LIFE AND FISHERIES COMMISSION  
400 ROYAL STREET  
NEW ORLEANS 70130

CLARK M. HOFFPAUER  
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CHAIRMAN  
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HOBSON NORRIS  
WEST MONROE

CLARENCE G. GUIDRY  
HOUMA

JAMES L. WINFREE  
BATON ROUGE

May 1, 1970

To Governor John J. McKeithen  
and Members of the Legislature  
State Capitol  
Baton Rouge, Louisiana

Gentlemen:

The Louisiana Wild Life and Fisheries Commission takes pride in presenting to you and the people of Louisiana this thirteenth Biennial Report covering the calendar years ending December 31, 1968 and December 31, 1969.

This report does more than summarize the revenue and expenditures of the Louisiana Wild Life and Fisheries Commission. This could be done in a more concise document. In its narrative can be found the activities, programs and accomplishments of the Commission. Throughout the contents is included the expanded research activities of the Commission staff and the findings. These are important to libraries, researchers, wildlife management students, and similar wildlife commissions in other states. It is the only permanent, comprehensive record of wildlife and fisheries management in Louisiana over a two-year period.

Unlike many other reports, this Biennial Report is a vast reservoir of information that will be utilized by students, teachers and natural resources workers for years to come. It is submitted with pride for it contains a report of what has been done and an outline of what must be accomplished.

We wish to take this opportunity to express appreciation to you and the citizens of Louisiana for your interest and contributions to the programs and projects that have been completed. We request your assistance in preparing for the future challenges that face this Commission.

Respectfully submitted,

*Clark M. Hoffpauer*

Clark M. Hoffpauer  
Director

*Louisiana Wild Life  
and  
Fisheries Commission*

JERRY G. JONES, *Chairman* .....Cameron  
H. CLAY WRIGHT, *Vice-Chairman* .....Evergreen  
JOHN E. KYLE, JR. ....Berwick  
JIMMIE THOMPSON .....Alexandria  
HOBSON NORRIS .....West Monroe  
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JAMES L. WINFREE .....Baton Rouge

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*Asst. Director*



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*Asst. Director*

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TED FORD  
Chief, Oyster, Water Bottoms and Seafood

HARRY SCHAFER  
Dingell-Johnson Coordinator

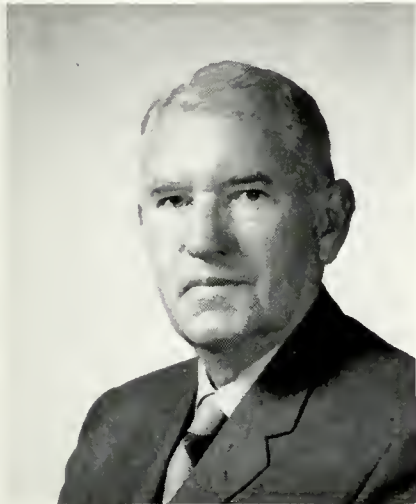
LARRY COOK  
Fiscal Officer

McFADDEN DUFFY  
Information Officer

*Louisiana Wild Life  
and  
Fisheries Commission*



JERRY G. JONES



JAMES L. WINFREE



H. CLAY WRIGHT



JIMMIE THOMPSON



CLARENCE A. GUIDRY



JOHN E. KYLE, JR.



HOBSON NORRIS

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# Administration

**P**UBLIC, commercial and industrial uses of Louisiana's wildlife, fisheries, and natural resources during the past two years has broadened greatly the scope of activities and responsibilities of the Louisiana Wild Life and Fisheries Commission.

At custodial and management levels the Louisiana Wild Life and Fisheries Commission has had to reorganize its activities and programs to meet the fluid requirements of constantly changing demands for multiple use of land and water resources.

During the biennium covered in this report the Commission has accelerated its research and management programs to provide greater outdoor recreation in the form of hunting, fishing, boating, camping and picnicking for a steadily increasing segment of Louisiana's citizens.

Statistical research indicates that well over 1,000,000 persons in the State participate in sport fishing. This figure is drawn from population surveys and not predicated upon license sales covered elsewhere in the Biennial Report. No fishing licenses are required of persons who have not reached their 16th birthday, nor of the esti-



**CLARK M. HOFFPAUER**  
Director

mated 400,000 or more persons who fish with cane poles and who are not required to be licensed.

It is estimated from license sales and statistical research among non-licensed hunters that in excess of 400,000 persons in Louisiana are resident hunters.

This has resulted in ever increasing demands by the public for areas in which to hunt and fish. The challenge presented to the Commission is being met by fish and game programs aimed at producing the maximum yield of wildlife resources from available lands and waters.

Increased demands by a public with more opportunity for outdoor recreation focuses atten-



**LYLE S. ST. AMANT**  
Asst. Director



**R. K. YANCEY**  
Asst. Director

tion on the Commission's long-range program to acquire outright ownership of lands whenever such lands are available and sufficient funds are provided for land acquisition.

Alternative measures include the leasing of lands on long-term basis for management and public use of hunting and fishing resources. This latter program is a stop-gap measure to meet present demands for outdoor recreation but falls short of the objectives of permanent acquisition of lands to meet the obvious needs of both present and future generations.

Undoubtedly the most important accomplishment in direct acquisition of land to be permanently dedicated to recreational use was made on October 7, 1968, when the Louisiana Wild Life and Fisheries Commission acquired 55,974 acres of land in parts of St. Charles, Terrebonne and Lafourche Parishes from the Humble Oil Company.

Two tracts of marshland were acquired at a cost of \$1,170,596.91 or approximately \$21 an acre. One tract, Salvador Wildlife Management Area, is located approximately 12 miles southwest of New Orleans and borders the west bank of Lake Cataouatche and the south bank of Lake Salvador. It contains approximately 27,000 acres and will be utilized as a wildlife management area; now meeting the growing needs of sportsmen who do not now have a place to hunt or fish.

This particular area, as well as the second tract, is being utilized as a wildlife management area for waterfowl, furbearing animals, deer, alligators, rabbits and other forms of marsh life.

The second area in the purchase, Point-a-Chien Wildlife Management Area, consists of roughly 28,000 acres and is located 15 miles southeast of Houma in what is known as the Grand Bayou Lake Area. It is being managed similarly to the first tract mentioned, and is providing sportsmen with additional Commission-managed public hunting and fishing land and water; giving them more places in which they can enjoy outdoor recreation.

The importance of outright purchase of land whenever possible is part of the Commission's effort to assure sportsmen of permanent areas where they may be able to hunt or fish. The soundness of this program can be witnessed throughout Louisiana, as well as in other states, where land and wetlands offering habitat for wildlife are being put into agriculture and other uses at a rapid rate.

Each passing year finds more land being converted to agricultural and industrial use. It has become imperative that the Commission accelerate the program of outright purchase of land and marshland whenever funds for such purposes are available. This is the only way we can assure generations of opportunity to hunt and fish on public lands, permanently dedicated as wildlife management areas.

This relatively large purchase of land in Octo-



**SAM MURRAY**  
Exec. Assistant

ber, 1968, followed several months after the May 16, 1968 purchase of 4,009 acres of land in Concordia Parish for use as a wildlife management area. That tract was adjacent to the Red River Wildlife Management Area which consists of 12,600 acres, purchased in December of 1966. It brought the total acreage of the tract under management to 16,000 acres.

The additional acreage consisted of approximately 3,000 acres of forest land ideally suited for wild turkey and deer; and roughly 1,000 acres of cleared pasture land that is being managed for quail, doves, and rabbit hunting.

Another important accomplishment in providing additional lands and water areas for use by sportsmen came in early 1969 when approximately 23,000 acres was obtained by lease from the Orleans Levee District. Leasing of the land to the Commission culminated eight years of effort by the Commission, many individuals and sportsmen's organizations.

The Bohemia Wildlife Management Area, the acreage mentioned, is located in Plaquemines Par-



**LESLIE L. GLASGOW**  
Assistant Secretary of the Interior  
for Fish and Wildlife, Parks, and  
Marine Resources who served as  
Director for the period January 1,  
1968, to January 6, 1969.

ish and is bordered by 20 miles of frontage on the Mississippi River, which serves as the western boundary, on the Northwest by the town of Bohemia, on the Southeast by the town of Ostrica, and extending east southeast by the open sea.

The ecology of this marsh area begins as an extremely saline type on the eastern periphery to a brackish marsh further westward, and to a fresh marsh adjacent to the Mississippi River Levee.

Excellent year round salt water fishing is to be found in the numerous large bays and bayous contained within the confines of this management unit.

The numerous oil company canals in the interior marsh afford excellent winter fishing for speckled trout, sheepshead, redfish, drum and other species. The oyster reefs found in nearby bays are excellent summer and fall locations for the same salt water species. Excellent shrimping and crabbing are also had in the same bays, lagoons and bayous.

Hunting opportunities are extremely varied. One can hunt rails in the short vegetative stands of oyster grass, ducks in the many ponds and lagoons, snipe in the interior marsh, doves, rabbits and deer along the Mississippi River. The numerous spoil banks created by oil company canal dredging also afford excellent rabbit hunting.

## Administration

It is anticipated that a substantial deer herd increase will result in the immediate future from increased patrolling and enforcement activities in the management area.

Full cooperation from the Plaquemines Parish Commission Council has been assured by Chalin Perez, President, in all Louisiana Wild Life and Fisheries Commission management endeavors.

It is felt that with proper management, habitat manipulation, and rigid enforcement, the game and fish species can be greatly benefited in many instances, with a substantial increase and harvest by the average hunter and fisherman.

Another major accomplishment during the biennium was the acquisition of Sabine Islands for a new wildlife management area. This was made possible through the interest and efforts of the Register of State Lands, Mrs. Ellen Bryan Moore.

The Commission entered into a 25-year lease in 1968, creating the Sabine Island Wildlife Management Area. The 7,143-acre management area will provide year round fishing and some deer hunting, along with excellent squirrel and rabbit hunting for years to come.

Duck hunting is mainly for wood ducks, although during certain times of the year, mallards frequent part of the area. The Commission permits waterfowl hunting in season, the only restriction being erection of permanent blinds.

It is sincerely hoped that additional funds will be made available to continue to acquire suitable



**H. B. FAIRCHILD**

Member of the Louisiana Wild Life and Fisheries Commission during the biennium covered in this report until this resignation November 20, 1968.

lands for permanent management. The Commission's land acquisition program is considered one of its most necessary long-range programs. The importance of land acquisition has been intensified due to the accelerated rate at which lands are being cleared for agricultural use, particularly in northeast Louisiana.

Louisiana leads the nation in seafood production, which includes shrimp, blue crabs, oysters and menhaden. This state alone contributes an annual average of more than 50 per cent of the commercial fishery products of the Gulf of Mexico.

During the last two years as well as the previous years, shrimp production was number one in monetary value, estimated at \$25,000,000 dock-side value for an average production of 40-80,000,000 pounds of shrimp. Menhaden was number one in poundage.

Marine fisheries research conducted by the Oyster, Water Bottoms and Seafood Division contributes greatly to increasing the poundage and value of Louisiana's seafood industry.

## Aviation Section

The Aviation Section has played an indispensable role in the program of the Wild Life and Fisheries Commission in the past two years. Law enforcement work, pollution detection, wildlife inventories, range surveys and emergency assistance during disaster periods has dominated the daily flight activities of the Aviation Section.

Planes operated by the section have been based at the Lakefront Airport and Westwego Airport in New Orleans. Three light single engine aircraft on floats, one twin engine amphib and two light single engine aircraft on wheels comprised the inventory of the Aviation Section during the past biennium.



Two-way radio contact between Commission planes and patrol boats expedites apprehension of illegal shrimp trawlers. Amphibious planes such as the widgeon can land near violators and confiscate illegally used trawls such as the one shown.

The topography of Louisiana's vast coastal marsh area is such that law enforcement work, pollution detection and game surveys would be virtually impossible without the use of aircraft. The thousands of bays, inlets and waterways that interlace the marshes could not be adequately covered by any other means. Oil spillages and other forms of surface pollution can be quickly spotted from the air in the coastal areas and weekly patrols along the coast have done much to suppress what would otherwise be major spillages of oily materials. Controlling out of season shrimping on inside waters along Louisiana's four million acres of coastal marshes has been a major activity of the Aviation Section. The Commission's excellent radio communication system between planes, boats and vehicles makes the use of aircraft even more valuable.

Planes have been steadily used in censusing waterfowl populations and in operations such as spotting deer for trapping and transplanting purposes. Wild turkeys, as well as the eggs of wall-eyed pike and striped bass, have also been quickly moved from one area to another by means of plane to reduce mortality.

Information on wildlife populations and game ranges gathered from the air has also been



Use of Commission float plane has greatly benefited shrimp research work by the Oyster, Water Bottoms and Seafood Division of the Commission. Spot checking of post-larval shrimp growth along the entire Louisiana coast can be made quickly, eliminating costly use of boats and personnel over long periods of time.

important in the establishment of hunting regulations in the state. Whenever fish kills have occurred in Gulf waters in the past two years evaluations have been made from the air.

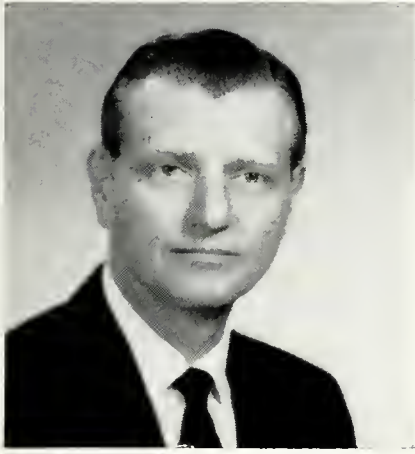
Commission aircraft have also traveled to Northern Canada and Southern Mexico during the past two years gathering information on migratory waterfowl populations. Louisiana's duck hunting regulations are established in Washington and since the Wild Life and Fisheries Commission annually makes recommendations on seasons and bag limits, it is important that Commission personnel be kept abreast of waterfowl conditions throughout the Mississippi Flyway.

During the aftermath of Hurricane Camille, Commission aircraft worked full time in search and rescue operations. During periods of major disaster such as coastal hurricanes, the airplanes have played an important role in emergency operations.

Immediately after Hurricane Camille the Commission's Widgeon flew countless missions, carrying both personnel and equipment to areas that had been devastated by the worst hurricane in history. Hundreds of flying hours were logged as the aftermath of this hurricane alone.



Work horse of the Louisiana Wild Life and Fisheries Commission's Aviation Section is this twin engine Widgeon amphibious aircraft. The six-place plane is used extensively in shrimp patrol and water pollution enforcement activities.



**WILLIAM G. McCARROLL**  
Personnel Officer

## Personnel Section

Most frequently used personnel data have been entered into our computers and periodic print-outs provide us with current information on every employee. Identification of employees who are eligible for salary step increases is provided each month, and our system of leave accounting has also been computerized.

The physical facilities of the personnel office have been improved to the extent that the general appearance is now representative of pleasant and efficient working conditions within the Commission. This is of vital importance in creating favorable first impressions with prospective new employees.

A new Kardex filing system has been established for the maintenance of Employee Service Record Cards and Leave Cards, and other critically needed office equipment has been added to improve the overall operating efficiency of the personnel management function. Currently in progress is a project for improvement of employee personnel files through the use of newly acquired sectionalized folders which will facilitate location of the various types of personnel actions.

Plans are presently being formulated for the conduct of formal inservice training programs which are designed to improve employee performance capabilities. Various publications pertaining to effective supervision and management are currently under subscription and many employees have participated in functional training courses offered by institutions and organizations outside the Commission.

Future progress toward our ultimate goal for complete and comprehensive personnel management and training will, of course, be contingent upon the availability of funds and supporting personnel to implement and sustain additional programs which will enhance the quality of employee services to the State.



**CLAUDE LeBLANC**  
Wharf Superintendent

## Wharf

During the past biennium the Wharf and the Marine and Radio Repair Department of the Commission, located in New Orleans on the New Basin Canal, near Lake Pontchartrain, has undergone many drastic changes for the better.

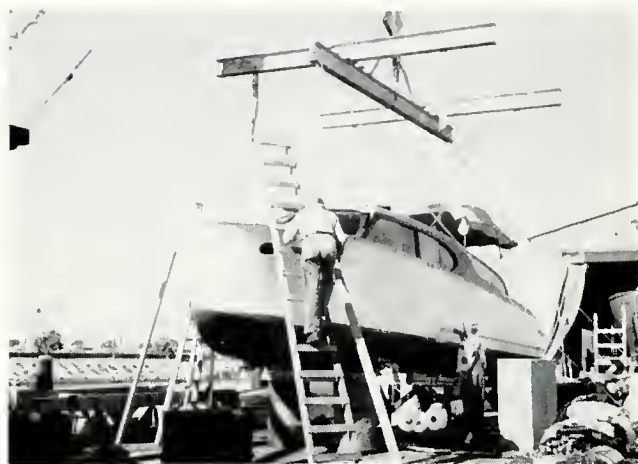
Major repairs by Wharf personnel have consisted of construction of 1200 square feet of working area for new offices and radio shop and the installation of central air and heat systems. Many of these repairs have been necessitated by storm damage.

The machine shop and outboard motor shops have been completely rebuilt and installation of modern testing equipment and tools for complete overhaul of all inboard and outboard engines has been effected. This includes facilities for major repairs to the newest inboard and outboard engines.

A new building, over water, for repairs to



The Patrol Boat Pelican was utilized in shrimp patrol and water pollution enforcement activities during the biennium covered. It is shown at its mooring alongside the Commission's wharf at West End in New Orleans.



Personnel at the Commission's wharf are capable of maintaining all types of boats from small outboard powered craft to cabin vessels. The installation of most Commission radios and communications equipment is also handled at the wharf.

vessels and boats during foul weather was constructed for the Commission. This new building is 35 feet wide by 90 feet long. The building is also used for dry storage for craft standing by for repairs.

The Wharf is now also equipped to make repairs on all fiberglass boats owned and operated by the Commission. The unit operates with a crew of 17 men who are on hand to do anything from a minor engine adjustment to a major "haulout" and full repair.

The Wharf also operates its own stiffleg derrick which means that craft up to fifty feet in length are simply lifted from the water for repairs. The craft are deposited into the docks, shorn up, and the workmen are able to begin their jobs with the workshop facilities right at hand. This effects a saving of time and labor.



Hoist with cradle is capable of lifting all Commission boats from water for hull repair and painting. Wharf facilities for boat repair result in substantial saving in Commission funds over work that is normally contracted for by other state agencies using similar equipment.

Many pieces of equipment in need of repair or servicing are brought in to headquarters. However, when it is more economical, crews are sent out to effect repairs in any part of the state. The radio repair and installation section operates a completely equipped radio repair van, which conducts on the spot repairs.

The 170-foot radio tower at the Wharf has a clear range of statewide transmission of communications and receptions. Remote control through the main office makes it possible to have constant communications with planes, boats and mobile units, throughout the state. The radio section also services and effects storm damage repairs to the commission's 18 radio towers located at strategic points.

The commission's marine equipment now consists of 500 outboard motors ranging from six to 135 horsepower, four hundred outboard hulls, ranging from 10 to 17 feet, and 72 vessels ranging from 19 to 60 feet.

During the past bienium there have been approximately 175 repairs to the commission's larger vessels, including overhaul, major repairs, haulouts and engine repairs. During the past two year period there were major repairs to all motor boat trailers from 800 pounds to 6400 pounds capacity. During these past two years there have been 500 outboard motor repairs.

The Wharf is fully equipped to test-run all new boats bought by the commission and begins work on these new craft as soon as they arrive.

## Building

The Wild Life and Fisheries Commission Building is ideally located at 400 Royal Street in New Orleans. Its downtown location makes it easy for persons to obtain hunting and fishing licenses or register boats.

At the time of its purchase from the City of New Orleans on August 6, 1957, it was estimated that it would be 75 years before it would show any sign of marked deterioration and that period



**RUDY DUVILLE**  
Building Superintendent

of time is being extended by complete maintenance.

The maintenance and custodial crews under the building superintendent consist of 20 men, working in two shifts. Their duties include operation of the elevators, painting, plastering and general repairs, as well as operating the heating and cooling systems. All are on 24-hour call to handle any problems that might arise regarding operation of the building.

During the biennium, the main offices of the Commission were renovated.

The Commission utilizes the main floors of the building for its offices and the Louisiana Wildlife Museum. The curator has an office and workshop on the second floor. Other agencies located on the second floor include the Greater New Orleans Tourist Commission, the Orleans Levee Board, State Division of Administration, the Alcoholic Beverage Control Board and the Gulf States Marine Fisheries Commission. U. S. District Courts, and the U.S. 5th District Court of Appeals are located on the fourth and third floors respectively. Two additional offices of the Federal Courts are located on the second floor.

In addition to other duties listed, this section also provides watchman service, and nightly office cleaning service.

## Information Section

The Louisiana Conservationist, official publication of the Louisiana Wild Life and Fisheries Commission, has a new colorful look. The Conservationist, printed for nearly 21 years in black and white, was converted completely to color to give readers a full, accurate picture of Louisiana's wildlife resources and the Commission's programs and activities.

The change in the format of the Conservationist came with the July-August, 1969, issue. Enthusiastic response to the new, full-color magazine can be counted in the thousands of letters praising the Louisiana Conservationist. Comments and messages were received from throughout the state, the nation and from international interests.

Action to convert the magazine to eye-catching color came after an investigation of various types of printing showed that the unit cost of offset printing, with the use of color, is cheaper than the traditional letterpress black and white format. The bi-monthly magazine has also been expanded to 32 pages to tell more of the natural resource story in Louisiana.

The Commission has found that dynamic visual and written impact upon the reader is most important to gain the public's understanding of the Commission's programs, problems and activities. The scientific-based articles can now be fully understood with color photographs showing true-

to-life subjects ranging from the challenge and fun of hunting and fishing, to intensive wildlife management, to fisheries resource research, to the study and protection of endangered species, to environmental pollution problems. Only through color photography can the true, natural story of Louisiana's outdoors be told.

This story is reaching more of Louisiana's citizens than ever before. The appeal of full color and the magazine's livelier format is measured by the increased influx of subscription requests received daily. Since the change in July, 1969, circulation of the Louisiana Conservationist has increased from some 90,000 to 103,000. About 750 requests for the magazine are delivered each month to the Information Section office. Each request is processed, names and addresses are placed on IBM tape labels and the written requests are filed. Mailing of the magazine has been moved from Baton Rouge to New Orleans and is handled by the printing company to get the magazine into the hands of the readers as soon as it comes off the presses.

During the past two years, the Louisiana Conservationist celebrated its 20th anniversary with the September-October, 1968, issue. In September, 1948, the Louisiana Wild Life and Fisheries Commission published Volume 1, Number 1 of the magazine. Since that date, the magazine has presented many new ideas based on scientific knowledge as well as tips for anglers and hunters.

Through the past 20 years, the Louisiana Conservationist has formally fostered every movement for the betterment of game and fish management. New ideas based on scientific knowledge have been presented, as well as hunting and fishing conditions. Every problem and activity of the Commission has been focused upon during the past two decades. Even issues extending beyond the state into the national level are publicized and explained in the Louisiana Conservationist.

The magazine is a direct link with the general public; at the same time, the Information Section serves as liaison between the Commission and the mass media. Coverage of the Commission's activities and programs is handled through this office. Press conferences held by the director, Commission members or division chiefs for fast-breaking news or special events are coordinated by the staff with newspapers, television and radio stations.

The Information Section is in constant contact with all divisions within the Commission to publicize their activities. About 15 news releases are issued each month to the state's some 130 newspapers and all the television and radio stations. Returns from clipping services show that more than 80 percent of the news releases are used in full or in part.

Louisiana's vast wealth of natural resources is graphically on display in the Louisiana Wildlife



An estimated 120,000 visitors pass through the Louisiana Wildlife Museum each year on Royal Street. Museum receives large numbers of school children visiting by bus from all parts of the state. It is one of the largest and best equipped state wildlife museums in the country.

Museum at the Commission's building, 400 Royal St., New Orleans. More than 120,000 visitors spend hours free of charge in the museum, which is only one of several in the country operated by a state agency. While Louisiana residents make up the bulk of visitors to the museum, the register signed by visitors represent every state in the union and many foreign countries. Tourists of all ages wandering through the French Quarter make a point of stopping at the museum. School groups throughout the state make annual trips to New Orleans to visit it.

The main room of the museum, which measures 35 feet by 90 feet, exhibits most of the 387 species of birds that have been recorded in Louisiana. In addition, there are also exhibits of bird eggs, mammals, fish, turtles and snakes. The museum is open Monday through Friday with visiting hours from 8:30 a.m. to 5 p.m., except on holidays.

Rare exhibits on display include a pair of passenger pigeons, now totally extinct in the world; the ivory-billed woodpecker, believed virtually extinct; and a mounted replica of the State Seal showing a brown pelican and a nest of three young pelicans.

In an adjacent room, measuring 30 feet by 45 feet, a waterfowl display shows 25 species of ducks and geese in life-like flight. The total ex-

hibit is 90 feet in length. Also in this room, many smaller habitat groups are on display, from the little Eastern chipmunk to the stately wild turkey. In the museum is the prairie chicken, once plentiful but now extinct in Louisiana.

Long hours of work went into the placement of natural looking foliage and life-like appearance of the mounted birds and animals. In conjunction with the museum's operation, there are portable exhibits which travel to every major fair and festival and are placed in hotels for wildlife meetings and conventions.

During the past biennium, the Information Section planned the publicity and assisted in the programs of four conventions and conferences held in New Orleans. The staff arranged for daily coverage of the joint conventions of the International Association of Game, Fish and Conservation Commissioners, 59th annual meeting, and the American Fisheries Society, 99th annual meeting held September 7-13, 1969, in the Roosevelt Hotel. Hundreds of delegates representing every state in the union and many foreign countries attended the successful convention.

The annual conference of the American Association for Conservation Information drew many national representatives to the meeting in New Orleans, June 2-5, 1968. The Information Section played an integral part in planning and



**McFADDEN DUFFY**  
Information Officer

hosting the conference, headquartered at the Monteleone Hotel.

In spring, 1969, two groups held their annual conferences in New Orleans. The Gulf States Marine Fisheries Commission held their spring meeting March 26-28, 1969, and the South Central States Boating Law Administrators Association held the ninth annual conference April 9-11, 1969.

The photography department, while limited to one full-time photographer, worked with all the conventions, sending prints to participants. Hundreds of requests for outdoor photographs, in black and white and in color, come into this office from newspapers, other state agencies, national



**BOB DENNIE**  
Photo Journalist

magazines and outdoor writers. In addition, a backlog of color transparencies is continually growing for future issues of The Conservationist. Photographs are also taken by the magazine editor and staff writer. The demands for 16 mm motion pictures has increased so the staff is working to accumulate movies of activities as they happen, such as pollution or the opening of hunting seasons. Special television series and feature programs have been coordinated and programmed by the staff.

The Information Section also serves as a clearing house for all types of information on Louisiana's wildlife and fisheries resources. About 35 telephone callers seek information daily on specific areas, or request pamphlets and brochures on various forms of wildlife. Thousands of request come in the mail from school children, Louisiana residents, other state agencies and federal bureaus. In addition, at least 25 persons visit the office daily seeking information of all sorts. These visits are from tourists, school teachers, students and persons wanting to know locations of recreation areas and regulations concerning hunting and fishing.

The Information Section, as the vital link between the Commission and the public, keeps its finger on the pulse of public attitudes, the growing awareness of the need for conservation and preservation of wildlife resources and intensified interests in such problems as pollution, public land use and preservation of the estuarine areas.



**LYN JOHNSON**  
Information Representative

# Fiscal Division

**T**HE FISCAL DIVISION maintains all the financial records of the Commission, is responsible for the collection, receipt and accounting for all income and funds, the disbursing and recording of all expenditures, and the preparation of financial and budgetary reports. During the past two years the activities have been continued and expanded.

This Division is responsible for the preparation and submitting of the annual budget requests to the Division of Administration. Twice in the past period it has received the budget requests of the operating Divisions, provided further information, typed, reproduced and assembled the finished requests.

It maintains the motorboat registration for the State of Louisiana, with more than 93,000 current registrations in file. This program produced \$244,000 during the last two fiscal years and involved 67,800 individual motorboat registration transactions processed during this period. These figures attest to the popularity of the motorboat in Louisiana.

The IBM 360-20 computer provides the means of recording all financial transactions, providing budgetary reports, preparing motorboat certificates of number and commercial licenses, and furnishing any list or report from the IBM card records. New uses of the machine include expanding reports by rapid sorting to provide different classification, reporting of employees' leave records monthly, and updating the Conservationist mailing list with new addresses and change of address.

The books of the Commission are audited by the Legislative Auditor, as well as by Federal auditors insofar as they pertain to the programs of Fish and Game research and development, Water Hyacinth Control, Water Pollution Control and Commercial Fisheries research and development.



**LAWRENCE H. COOK**  
Fiscal Officer

## Index to Accounting and Statistical Reports

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# Exhibit 1

## LOUISIANA WILD LIFE AND FISHERIES COMMISSION

### BALANCE SHEET

June 30, 1969

|                                | ASSETS                 |                      |                        | LIABILITIES          |                        |                               |
|--------------------------------|------------------------|----------------------|------------------------|----------------------|------------------------|-------------------------------|
|                                | Cash                   | Accounts Receivable  | Total Assets           | Accounts Payable     | Liabilities Surplus    | Total Liabilities and Surplus |
| Conservation Fund.....         | \$ (153,209.20)        | \$ 401,293.88        | \$ 248,084.68          | \$ 247,465.25        | \$ 619.43              | \$ 248,084.68                 |
| Marsh Island Fund.....         | 70,016.60              |                      | 70,016.60              | 13,777.33            | 56,239.27              | 70,016.60                     |
| Rockefeller Fund.....          | 70,213.74              |                      | 70,213.74              | 27,925.27            | 42,288.47              | 70,213.74                     |
| Oyster Seed Ground Fund.....   | 1,221,428.72           |                      | 1,221,428.72           | 38,586.45            | 1,182,842.27           | 1,221,428.72                  |
| Commercial Seafood Fund.....   | 1,574,983.25           |                      | 1,574,983.25           | 27,538.95            | 1,547,444.30           | 1,574,983.25                  |
| Commercial Fisheries Fund..... | (75,850.12)            | 84,771.92            | 8,921.80               | 8,921.80             |                        | 8,921.80                      |
| Seismic Fund.....              | (78,038.29)            |                      | (78,038.29)            |                      | (78,038.29)            | (78,038.29)                   |
| APW Boat Ramp Fund.....        | 16,464.35              |                      | 16,464.35              |                      | 16,464.35              | 16,464.35                     |
| Bodeau GMA Fund.....           | 75,746.12              |                      | 75,746.12              |                      | 75,746.12              | 75,746.12                     |
| <b>TOTAL.....</b>              | <b>\$ 2,721,755.17</b> | <b>\$ 486,065.80</b> | <b>\$ 3,207,820.97</b> | <b>\$ 364,215.05</b> | <b>\$ 2,843,605.92</b> | <b>\$ 3,207,820.97</b>        |



Personnel in the Fiscal Division located in the Commission's main office in New Orleans handle all purchase orders, payroll, license sales and distribution and other details pertaining to financial operation of the Commission.



All records of the Commission's financial operations are supervised by a relatively small staff of competent accountants who utilize high speed data processing machines to expedite all fiscal matters.



Modern equipment facilitates boat registration which is one of the services handled by the Fiscal Division.

## Exhibit 2 APPROPRIATIONS

|                                   | 1967-68<br>Actual | 1968-69<br>Actual | 1969-70<br>Budget |
|-----------------------------------|-------------------|-------------------|-------------------|
| CONSERVATION FUND.....            | \$5,396,575.00    | \$5,723,252.00    | \$4,506,895.00    |
| FEDERAL FUNDS:                    |                   |                   |                   |
| Pittman-Robertson.....            | 358,505.94        | 405,197.71        | 300,000.00        |
| Dingell-Johnson.....              | 75,190.07         | 87,589.36         | 80,000.00         |
| Hyacinth Control.....             | 90,685.05         | 83,723.53         | 60,000.00         |
| Water Pollution Control.....      | 139,509.24        | 142,725.18        | 140,000.00        |
| Bureau of Outdoor Recreation..... | 287,266.19        | .....             | .....             |
| Commercial Fisheries.....         | 299,775.83        | 233,678.65        | 220,000.00        |
| DEDICATED FUNDS:                  |                   |                   |                   |
| Marsh Island Fund.....            | 1,030,350.00      | 483,450.00        | 1,095,478.00      |
| Rockefeller Fund.....             | 905,723.00        | 1,055,723.00      | 467,779.00        |
| Oyster Seed Ground Fund.....      | 574,068.00        | 532,283.00        | 663,911.00        |
| Commercial Seafood Fund.....      | 568,790.00        | 490,219.00        | 622,140.00        |
| Commercial Fisheries.....         | 195,089.00        | 250,173.00        | .....             |
| GENERAL FUND.....                 | 111,166.00        | 372,046.00        | .....             |
| TOTAL.....                        | \$ 10,032,693.32  | \$9,860,060.43    | \$8,156,203.00    |

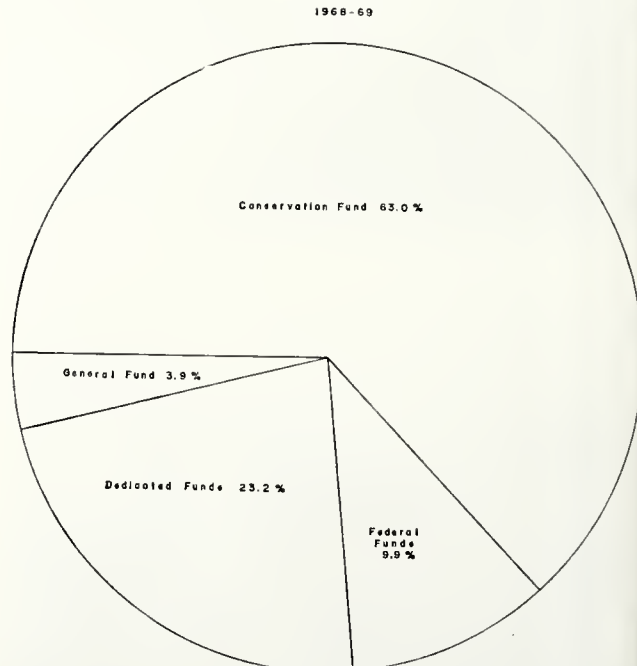
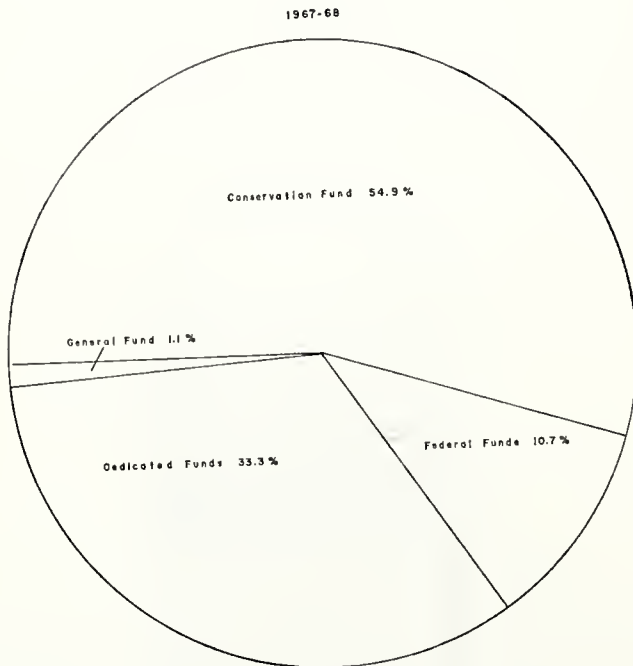


**Exhibit 3**  
**EXPENDITURES**  
**BY FUNDS AND DIVISIONS**

|                                | 1967-68<br>Actual | 1968-69<br>Actual |
|--------------------------------|-------------------|-------------------|
| Administrative.....            | \$ 434,221.08     | \$ 438,870.04     |
| Education and Publicity.....   | 201,469.10        | 190,924.88        |
| Water Pollution Control.....   | 224,502.80        | 231,394.06        |
| Enforcement.....               | 2,161,478.18      | 2,149,085.55      |
| Hyacinth Control.....          | 376,356.56        | 440,145.42        |
| Fish and Game.....             | 2,289,831.60      | 2,269,977.92      |
| Pittman-Robertson.....         | 455,870.00        | 521,410.73        |
| Dingell-Johnson.....           | 142,501.59        | 142,338.89        |
| Fur.....                       | 40,177.75         | 34,007.66         |
| Building.....                  | 156,713.18        | 166,407.88        |
| Total Conservation Fund.....   | \$ 6,483,121.84   | \$ 6,584,563.03   |
| Marsh Island Fund.....         | \$ 1,169,110.31   | \$ 366,049.90     |
| Rockefeller Fund.....          | 992,339.09        | 1,053,147.07      |
| Oyster Seed Ground Fund.....   | 573,242.93        | 454,523.23        |
| Commercial Seafood Fund.....   | 549,327.93        | 378,586.12        |
| Commercial Fisheries Fund..... | 447,902.73        | 326,980.08        |
| GRAND TOTAL.....               | \$10,215,044.83   | \$ 9,163,849.43   |

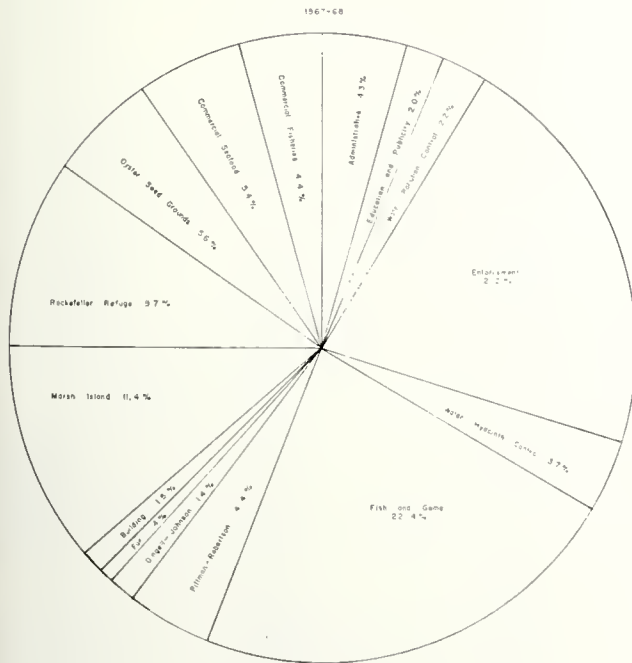


**Exhibit 3 A**  
**BUDGET 1969-70, BY DIVISIONS**

|                                                  |                 |
|--------------------------------------------------|-----------------|
| Administrative.....                              | \$ 505,726.00   |
| Fiscal.....                                      | 316,629.00      |
| Water Pollution Control.....                     | 244,781.00      |
| Enforcement.....                                 | 2,086,964.00    |
| Fur.....                                         | 31,811.00       |
| Fish and Game.....                               | 1,938,984.00    |
| Total Conservation Fund.....                     | \$ 5,124,895.00 |
| Refuge.....                                      | \$ 1,563,257.00 |
| Oyster, Waterbottoms and Commercial Seafood..... | 1,506,051.00    |
| TOTAL.....                                       | \$ 8,194,203.00 |

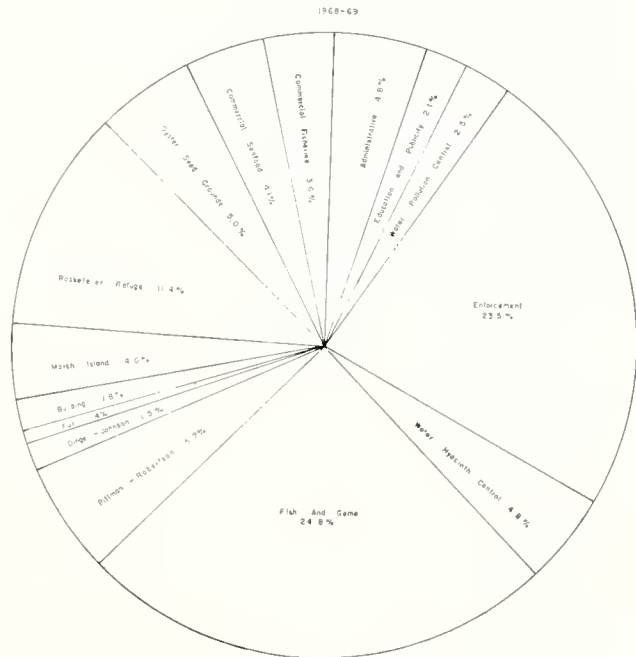


**Exhibit 4**  
**ALL RECEIPTS**  
**CONSERVATION FUND—DEDICATED FUNDS AND FEDERAL FUNDS**  
**ACTUAL RECEIPTS 1967-68 AND 1968-69—ESTIMATED RECEIPTS 1969-70**

| CONSERVATION FUND                                                             | Actual<br>1967-68 | Actual<br>1968-69 | Estimated<br>1969-70 |
|-------------------------------------------------------------------------------|-------------------|-------------------|----------------------|
| <b>Sport Licenses:</b>                                                        |                   |                   |                      |
| Fishing—New Orleans.....                                                      | \$ 53,960         | \$ 22,823         | \$ 40,000            |
| Fishing—Other Parishes.....                                                   | 392,850           | 301,144           | 210,000              |
| Total Fishing.....                                                            | \$ 446,810        | \$ 323,967        | \$ 250,000           |
| Hunting—New Orleans.....                                                      | \$ 35,257         | \$ 34,233         | \$ 35,000            |
| Hunting—Other Parishes.....                                                   | 754,835           | 788,034           | 750,000              |
| Total Hunting.....                                                            | \$ 790,092        | \$ 822,267        | \$ 785,000           |
| Total Sport Licenses.....                                                     | \$1,236,902       | \$1,146,234       | \$1,035,000          |
| <b>Commercial Fishing and Dealers:</b><br>(Including Fish, Shrimp and Oyster) |                   |                   |                      |
| Fresh Water Gill Net.....                                                     | \$ 24,955         | \$ 25,340         | \$ 25,000            |
| Commercial Fisherman—Bait Seller.....                                         | 3,785             | 7,140             | 7,000                |
| Hoop Net.....                                                                 | 10,195            | 10,810            | 10,000               |
| Fresh Water Seine.....                                                        | 1,805             | 1,645             | 1,500                |
| Fresh Water Trammel Net.....                                                  | 8,495             | 9,210             | 8,500                |
| Salt Water Fish and Shrimp Seine.....                                         | 2,475             | 2,985             | 2,500                |
| Salt Water Trammel Net.....                                                   | 1,930             | 2,295             | 2,000                |
| Salt Water Menhaden Seine and Vessel.....                                     | 6,200             | 6,805             | 6,500                |
| Oyster Vessel Tonnage.....                                                    | 1,328             | 1,837             | 1,300                |
| Oyster Dredging.....                                                          | 4,900             | 9,310             | 5,000                |
| Salt Water Fish Vessel.....                                                   | 365               | 345               | 300                  |
| Salt Water Shrimp Trawl and Vessel.....                                       | 215,541           | 186,280           | 185,000              |
| Salt Water Shrimp Freight.....                                                | 10                | 840               | 800                  |
| Oyster Bedding Ground.....                                                    | 118,987           | 112,438           | 110,000              |
| Oyster Shop and Resale.....                                                   | 1,580             | 1,835             | 1,500                |
| Wholesale Dealer.....                                                         | 14,400            | 14,000            | 14,000               |
| Wholesale Dealer's Agent.....                                                 | 630               | 540               | 500                  |
| Retail Dealer.....                                                            | 16,565            | 16,405            | 16,000               |
| Non-Resident Minnow Dealer.....                                               | 400               | 800               | 600                  |
| Fish Farmer.....                                                              | 1,400             | 1,460             | 1,200                |
| Total Commerical Fishing and Dealers.....                                     | \$ 435,946        | \$ 412,320        | \$ 399,200           |
| <b>Severance Tax:</b>                                                         |                   |                   |                      |
| Gravel.....                                                                   | \$.....           | \$.....           | \$.....              |
| Sand.....                                                                     | 4,751             | 631               | .....                |
| Fill Material.....                                                            | 150,156           | 181,805           | 200,000              |
| Fur.....                                                                      | 28,188            | 29,018            | 30,000               |
| Oyster.....                                                                   | 12,338            | 12,444            | 12,000               |
| Shrimp.....                                                                   | 50,388            | 45,153            | 40,000               |
| Total Severance Tax.....                                                      | \$ 245,821        | \$ 269,051        | \$ 282,000           |
| <b>Miscellaneous Licenses and Receipts:</b>                                   |                   |                   |                      |
| Hunting Club.....                                                             | \$ 1,600          | \$ 1,105          | \$ 1,000             |
| Hunting Preserve.....                                                         | 1,200             | 1,200             | 1,200                |
| Game Breeder.....                                                             | 1,620             | 1,720             | 1,700                |
| Transfer of Oyster Lease.....                                                 | 57                | 41                | 50                   |
| Resident Fur Buyer.....                                                       | 1,800             | 2,625             | 2,000                |
| Resident Fur Dealer.....                                                      | 2,100             | 2,550             | 2,500                |
| Non-Resident Fur Buyer.....                                                   | 100               | 300               | 300                  |
| Non-Resident Fur Dealer.....                                                  | 1,200             | 900               | 900                  |
| Trapper—New Orleans.....                                                      | 242               | 530               | 300                  |
| Trapper—Other Parishes.....                                                   | 4,320             | 6,452             | 4,000                |
| Miscellaneous.....                                                            | 13,126            | 21,137            | 8,000                |
| Total Miscellaneous Licenses and Receipts.....                                | \$ 27,365         | \$ 38,560         | \$ 21,950            |
| Motorboat Registration.....                                                   | \$ 119,068        | \$ 125,027        | \$ 120,000           |
| Building Rental.....                                                          | \$ 162,291        | \$ 144,566        | \$ 125,000           |
| Sale of Property and Equipment.....                                           | \$ 36,746         | \$ 160,902        | \$.....              |

EXHIBIT 4—Continued Next Page

**Exhibit 4 (Continued)**

**ALL RECEIPTS  
CONSERVATION FUND—DEDICATED AND FEDERAL FUNDS  
ACTUAL RECEIPTS 1967-68 AND 1968-69—ESTIMATED RECEIPTS 1969-70**

| CONSERVATION FUND                          | Actual<br>1967-68 | Actual<br>1968-69 | Estimated<br>1969-70 |
|--------------------------------------------|-------------------|-------------------|----------------------|
| Royalties from Leases:                     |                   |                   |                      |
| Oil and Gas.....                           | \$5,840,149       | \$6,600,939       | \$6,000,000          |
| Sulphur.....                               | 574,678           | 505,254           | 400,000              |
| Salt.....                                  | 1,090             | 56                | 100                  |
| Bonuses.....                               | 358,864           | 34,937            | .....                |
| Total Royalties from Mineral Leases.....   | \$6,774,781       | \$7,141,186       | \$6,400,100          |
| TOTAL CONSERVATION FUND RECEIPTS.....      | \$9,038,920       | \$9,437,846       | \$8,383,250          |
| DEDICATED FUNDS                            |                   |                   |                      |
| Oyster Seed Ground:                        |                   |                   |                      |
| Shell Severance Tax.....                   | \$ 579,736        | \$ 674,519        | \$ 600,000           |
| Survey Fees.....                           | 15,036            | 26,405            | 15,000               |
| Rebedding Fees.....                        | 3,187             | .....             | .....                |
| Interest.....                              | 24,999            | 24,719            | 20,000               |
| Miscellaneous.....                         | 302               | 2,861             | .....                |
| Total Oyster Seed Ground.....              | \$ 623,260        | \$ 728,504        | \$ 635,000           |
| Commercial Seafood:                        |                   |                   |                      |
| Shell Severance Tax.....                   | \$ 579,736        | \$ 674,519        | \$ 600,000           |
| Miscellaneous.....                         | .....             | 763               | .....                |
| Interest.....                              | 29,032            | 31,802            | 15,000               |
| Total Commercial Seafood.....              | \$ 608,768        | \$ 707,084        | \$ 615,000           |
| Rockefeller Refuge:                        |                   |                   |                      |
| Royalties from Mineral Leases.....         | \$1,548,384       | \$1,394,422       | \$1,600,000          |
| Geophysical Permit.....                    | 834,670           | .....             | .....                |
| Fur Sales.....                             | 3,004             | 3,048             | 2,000                |
| Interest.....                              | 10,484            | 3,750             | 5,000                |
| Agency Receipts, Interest Income, etc..... | 42,640            | 39,680            | .....                |
| Total Rockefeller Refuge.....              | \$2,439,182       | \$1,440,900       | \$1,607,000          |
| Marsh Island Refuge:                       |                   |                   |                      |
| Royalties from Mineral Leases.....         | \$ 452,273        | \$ 650,633        | \$ 500,000           |
| Pass-a-Loutre Hunting Permits.....         | 3,840             | 2,820             | .....                |
| Pasturage.....                             | 210               | 288               | 210                  |
| Fur Sales.....                             | 1,302             | 9,945             | 1,000                |
| Miscellaneous.....                         | 14,432            | 12,713            | .....                |
| Right-of-Way.....                          | .....             | 52,694            | 89,809               |
| Interest.....                              | 4,839             | 7,916             | 5,000                |
| Total Marsh Island Refuge.....             | \$ 476,896        | \$ 737,009        | \$ 596,019           |
| TOTAL DEDICATED FUNDS.....                 | \$4,148,106       | \$3,613,497       | \$3,453,019          |
| FEDERAL FUNDS                              |                   |                   |                      |
| Pittman—Robertson.....                     | \$ 125,000        | \$ 405,198        | \$ 300,000           |
| Dingell—Johnson.....                       | 275,000           | 87,589            | 80,000               |
| Hyacinth Control.....                      | 62,620            | 83,724            | 60,000               |
| Water Pollution Control.....               | 139,509           | 142,725           | 140,000              |
| Commercial Fisheries.....                  | 240,000           | 233,679           | 220,000              |
| Bureau of Outdoor Recreation.....          | 400,000           | .....             | .....                |
| Office of Emergency Planning.....          | .....             | .....             | .....                |
| Total Federal Funds.....                   | \$1,242,129       | \$ 952,915        | \$ 800,000           |
| GRAND TOTAL OF ALL RECEIPTS.....           | \$14,429,155      | \$14,004,258      | \$12,636,269         |

# Exhibit 5

## EXPENDITURES FUNDS, DIVISION AND MAJOR EXPENSE CLASSIFICATION—1967-1968

|                                | Travel        | Personal Services | Contractual Services | Materials & Supplies | Special Current Charges | Equipment Purchases | Major Repairs | Construction   | Administrative Charges | Total           | %    |
|--------------------------------|---------------|-------------------|----------------------|----------------------|-------------------------|---------------------|---------------|----------------|------------------------|-----------------|------|
| Administrative Div.....        | \$ 23,251.42  | \$392,977.08      | \$ 139,723.33        | \$ 70,094.73         | \$ 34,954.10            | \$ 36,785.62        | \$ 584.80     | \$.....        | \$(264,150.00)         | \$ 434,221.08   | 4.2  |
| Education and Publicity.....   | 1,296.78      | 55,811.50         | 119,898.70           | 14,737.91            | 5,280.59                | 4,143.62            | .....         | .....          | 300.00                 | 201,469.10      | 2.1  |
| Water Pollution Control.....   | 9,296.65      | 120,552.83        | 15,543.71            | 29,470.00            | 11,956.91               | 36,982.70           | .....         | .....          | 700.00                 | 224,502.80      | 2.2  |
| Enforcement.....               | 190,652.04    | 1,307,018.13      | 55,138.31            | 186,851.37           | 138,287.70              | 209,133.81          | 5,396.82      | .....          | 60,000.00              | 2,161,478.18    | 21.1 |
| Hyacinth Control.....          | 6,908.93      | 252,054.13        | 8,514.74             | 36,998.53            | 26,121.14               | 25,759.09           | .....         | .....          | 20,000.00              | 376,356.56      | 3.7  |
| Fish and Game.....             | 52,321.63     | 943,653.75        | 184,007.17           | 201,369.88           | 124,708.64              | 280,863.13          | 3,763.66      | 1,074,515.33   | 23,000.00              | 2,888,203.19    | 28.4 |
| Fur.....                       | 2,717.79      | 28,268.75         | 1,975.95             | 1,483.60             | 2,321.28                | 3,260.38            | .....         | .....          | 150.00                 | 40,177.75       | .4   |
| Building.....                  | .....         | 82,350.03         | 51,002.14            | 15,315.53            | 6,697.45                | 398.03              | 950.00        | .....          | .....                  | 156,713.18      | 1.5  |
| Total Conservation Fund.....   | \$ 295,445.24 | \$3,182,686.20    | \$ 575,804.05        | \$ 556,321.55        | \$ 350,327.81           | \$ 597,326.38       | \$ 10,695.28  | \$1,074,515.33 | \$(160,000.00)         | \$6,483,121.84  | 63.6 |
| Marsh Island Fund.....         | 853.29        | 92,442.94         | 17,536.49            | 62,923.41            | 10,226.58               | 9,479.09            | 30,648.51     | 925,000.00     | 20,000.00              | 1,169,110.31    | 11.4 |
| Rockefeller Fund.....          | 13,477.04     | 314,955.68        | 82,445.08            | 206,298.83           | 49,576.05               | 193,570.93          | 66,169.98     | 5,925.50       | 60,000.00              | 992,339.09      | 9.7  |
| Oyster Seed Grounds Fund.....  | 12,455.61     | 192,198.02        | 26,471.96            | 77,717.97            | 18,726.06               | 173,151.82          | 28,271.47     | 4,250.00       | 40,000.00              | 573,242.93      | 5.6  |
| Commercial Seafood Fund.....   | 24,999.46     | 159,331.45        | 28,680.52            | 48,976.27            | 16,483.17               | 48,433.00           | 24,166.35     | 158,257.64     | 40,000.00              | 549,327.93      | 5.3  |
| Commercial Fisheries Fund..... | 2,084.32      | 195,268.56        | 12,708.13            | 62,599.28            | 17,741.79               | 55,707.57           | 7,011.84      | 94,781.24      | .....                  | 447,992.73      | 4.4  |
| GRAND TOTAL.....               | \$ 349,314.96 | \$4,136,892.85    | \$ 743,646.30        | \$1,014,747.33       | \$ 463,081.46           | \$1,077,668.79      | \$ 166,963.43 | \$2,202,729.71 | \$.....                | \$10,215,044.83 | 100  |

PERCENTAGE.....

100%

# Exhibit 6

## EXPENDITURES FUNDS, DIVISIONS AND MAJOR EXPENSE CLASSIFICATION—1968-1969

|                                | Travel        | Personal Services | Contractual Services | Materials & Supplies | Special Current Charges | Equipment Purchases | Major Repairs | Construction   | Administrative Charges | Total          | %    |
|--------------------------------|---------------|-------------------|----------------------|----------------------|-------------------------|---------------------|---------------|----------------|------------------------|----------------|------|
| Administrative Div.....        | \$ 20,007.78  | \$ 421,990.83     | \$ 127,152.42        | \$ 64,362.13         | \$ 39,770.85            | \$ 22,224.41        | \$ 7,511.62   | \$.....        | \$(264,150.00)         | \$ 438,870.04  | 4.8  |
| Education and Publicity.....   | 598.71        | 52,874.77         | 120,657.49           | 8,640.52             | 4,959.60                | 2,887.79            | .....         | .....          | 300.00                 | 190,924.88     | 2.1  |
| Water Pollution Control.....   | 8,452.17      | 135,125.67        | 15,653.34            | 26,375.19            | 13,441.19               | 29,231.39           | 2,415.11      | .....          | 700.00                 | 231,394.06     | 2.6  |
| Enforcement.....               | 150,680.78    | 1,401,851.81      | 60,790.74            | 169,198.98           | 151,910.61              | 154,652.63          | .....         | .....          | 60,000.00              | 2,149,085.55   | 23.6 |
| Hyacinth Control.....          | 5,245.30      | 259,398.26        | 27,020.81            | 59,455.83            | 28,026.97               | 40,428.25           | .....         | .....          | 20,000.00              | 440,143.42     | 4.8  |
| Fish and Game.....             | 54,474.99     | 975,589.15        | 212,259.52           | 204,358.00           | 138,258.28              | 153,353.75          | 1,836.94      | 1,170,596.91   | 23,000.00              | 2,933,727.54   | 32.2 |
| Fur.....                       | 2,639.30      | 25,392.52         | 2,129.98             | 1,239.78             | 2,356.63                | 99.45               | .....         | .....          | 150.00                 | 34,007.66      | .4   |
| Building.....                  | .....         | 90,591.85         | 46,011.48            | 11,051.85            | 7,390.89                | 9,913.51            | 1,448.50      | .....          | .....                  | 166,407.88     | 1.8  |
| Total Conservation Fund.....   | \$ 242,099.03 | \$3,362,784.86    | \$ 611,675.78        | \$ 544,688.28        | \$ 386,714.82           | \$ 412,791.18       | \$ 13,212.17  | \$1,170,596.91 | \$(160,000.00)         | \$6,584,563.03 | 72.3 |
| Marsh Island Fund.....         | 2,252.55      | \$ 105,027.37     | \$ 14,714.82         | \$ 66,463.43         | \$ 12,173.61            | \$ 55,735.12        | \$ 56,583.00  | \$ 33,100.00   | \$ 20,000.00           | \$ 366,049.90  | 4.0  |
| Rockefeller Fund.....          | 12,542.74     | 349,719.27        | 72,514.94            | 186,574.43           | 64,550.75               | 80,569.95           | 163,595.66    | .....          | 60,000.00              | 990,067.74     | 10.9 |
| Oyster Seed Ground Fund.....   | 12,755.40     | 222,344.53        | 33,498.87            | 77,448.98            | 22,838.58               | 34,362.10           | 11,274.77     | .....          | 40,000.00              | 454,523.23     | 5.0  |
| Commercial Seafood Fund.....   | 23,876.65     | 165,426.94        | 34,588.20            | 46,766.13            | 17,237.96               | 36,136.24           | 14,254.00     | .....          | 40,000.00              | 378,586.12     | 4.2  |
| Commercial Fisheries Fund..... | 2,625.38      | 177,047.68        | 18,433.47            | 82,320.59            | 16,561.71               | 23,784.26           | 6,206.99      | .....          | .....                  | 326,980.08     | 3.6  |
| GRAND TOTAL.....               | \$ 296,151.75 | \$4,352,350.65    | \$ 785,726.08        | \$1,004,261.84       | \$ 520,077.43           | \$ 643,378.85       | \$ 265,126.59 | \$1,203,696.91 | \$.....                | \$9,100,770.10 | 100  |

PERCENTAGE.....

100%

# **BUDGET FUNDS, DIVISIONS AND MAJOR EXPENSE CLASSIFICATION—1969-1970**

|                                           | Personal<br>Services | Contractual<br>Services | Travel        | Materials<br>& Supplies | Special<br>Current<br>Charges | Equipment<br>Purchases | Major<br>Repairs | Construction | Administrative<br>Charges | Total          | %    |
|-------------------------------------------|----------------------|-------------------------|---------------|-------------------------|-------------------------------|------------------------|------------------|--------------|---------------------------|----------------|------|
| Administrative Div.                       | \$ 425,040.00        | \$ 156,731.00           | \$ 22,000.00  | \$ 85,000.00            | \$ 39,804.00                  | \$ 33,911.00           | \$ 7,000.00      | \$           | \$(263,850.00)            | \$ 505,726.00  | 6.1  |
| Fiscal                                    | 177,608.00           | 100,000.00              | 4,500.00      | 8,500.00                | 18,625.00                     | 7,396.00               |                  |              |                           | 316,629.00     | 3.8  |
| Water Pollution Control                   | 137,832.00           | 18,000.00               | 10,908.00     | 27,000.00               | 14,323.00                     | 32,935.00              | 3,000.00         |              | 700.00                    | 214,781.00     | 3.0  |
| Enforcement                               | 1,463,998.00         | 60,000.00               | 150,000.00    | 150,000.00              | 159,724.00                    | 38,242.00              | 5,000.00         |              | 60,000.00                 | 2,086,934.00   | 25.4 |
| Fur.                                      | 28,325.00            |                         | 831.00        |                         | 2,505.00                      |                        |                  |              | 150.00                    | 31,811.00      | .4   |
| Fish and Game                             | 1,259,849.00         | 200,000.00              | 50,000.00     | 200,000.00              | 158,439.00                    | 17,666.00              |                  |              | 43,000.00                 | 1,938,984.00   | 23.9 |
| Total Conservation                        | \$3,492,682.00       | \$ 534,731.00           | \$ 238,239.00 | \$ 470,500.00           | \$ 333,543.00                 | \$ 130,200.00          | \$ 15,000.00     | \$           | \$(160,000.00)            | \$5,124,805.00 | 62.6 |
| Refuge                                    | \$ 489,755.00        | \$ 186,000.00           | \$ 14,800.00  | \$ 231,203.00           | \$ 85,384.00                  | \$ 232,416.00          | \$ 213,196.00    | \$           | \$ 80,000.00              | \$1,563,257.00 | 19.1 |
| Oyster Water Bottoms & Commercial Seafood | 633,175.00           | 100,000.00              | 68,400.00     | 249,000.00              | 63,427.00                     | 184,049.00             | 128,000.00       |              | 80,000.00                 | 1,506,051.00   | 18.3 |
| TOTAL                                     | \$4,615,612.00       | \$ 820,731.00           | \$ 321,439.00 | \$ 980,706.00           | \$ 542,354.00                 | \$ 546,665.00          | \$ 356,196.00    | \$           | \$                        | \$8,194,203.00 | 100% |
| PERCENTAGE                                | 56.3                 | 10.0                    | 3.9           | 12.1                    | 6.7                           | 6.7                    | 4.3              |              |                           | 100            |      |

## **Exhibit 8 OTHER FUNDS**

### **SEISMIC FUND**

|                              | 1967/68       | 1968/69        |
|------------------------------|---------------|----------------|
| Unencumbered Balance July 1  | \$ 144,390.40 | \$ 57,057.87   |
| Adjustment                   | (4,659.75)    | 48.00          |
| RECEIPTS                     | 229,484.89    | 211,983.00     |
|                              | \$ 369,215.54 | \$ 269,088.87  |
| EXPENDITURES                 |               |                |
| Personal Services            | \$ 197,665.75 |                |
| Travel                       | 56,151.70     | \$ 202,633.77  |
| Contractual Services         | 40,166.04     | 55,842.40      |
| Ret. Hosp. and Soc. Sec.     | 18,174.18     | 39,669.38      |
|                              | \$ 312,157.67 | 20,150.92      |
| Unencumbered Balance June 30 | \$ 57,057.87  | ( \$49,207.60) |

### **BODCAU GAME MANAGEMENT AREA**

|                              | 1967/68      | 1968/69      |
|------------------------------|--------------|--------------|
| Unencumbered Balance July 1  | (\$8,319.37) | \$25,715.18  |
| Add Adjustments              | 225.80       |              |
| RECEIPTS                     | 33,808.75    | 51,808.49    |
| EXPENDITURES:                |              |              |
| Contractual Services         |              | \$ 67.20     |
| Materials and Supplies       |              | 92.35        |
| Construction                 |              | 24,940.00    |
|                              | None         | \$ 25,029.55 |
| Unencumbered Balance June 30 | \$ 25,715.18 | \$ 52,494.12 |

### **DUCKS UNLIMITED, INC.**

|                              | 1967/68      | 1968/69      |
|------------------------------|--------------|--------------|
| Unencumbered Balance July 1  | \$ 73,464.50 | \$ 77,968.00 |
| RECEIPTS                     |              |              |
| EXPENDITURES:                |              |              |
| Contractual Services         | \$ 73,404.50 | \$ 77,968.00 |
| Unencumbered Balance June 30 | None         | None         |

### **APW BOAT RAMPS FUND**

|                              | 1967/68      | 1968/69      |
|------------------------------|--------------|--------------|
| Unencumbered Balance July 1  | \$ 21,645.60 | \$ 22,034.19 |
| a/c Payable Adjustment       | 388.59       | (53.43)      |
| RECEIPTS                     | None         | None         |
| EXPENDITURES                 |              |              |
|                              | \$ 22,034.19 | \$ 21,980.76 |
| Unencumbered Balance June 30 | \$ 22,034.19 | \$ 21,980.76 |

**Exhibit 9**  
**LOUISIANA SHRIMP PRODUCTION BY SIZE (HEADS OFF)**

| Size (heads-off per pound) Number | 1968                  |                      |                       | 1967                  |                      |                       |
|-----------------------------------|-----------------------|----------------------|-----------------------|-----------------------|----------------------|-----------------------|
|                                   | Quantity<br>1000 lbs. | Per Cent<br>of Total | Value to<br>Fishermen | Quantity<br>1000 lbs. | Per Cent<br>of Total | Value to<br>Fishermen |
| Under 15.....                     | 767                   | 1.8                  | 1.398                 | 694                   | 1.4                  | 1.192                 |
| 15-20.....                        | 3,107                 | 7.3                  | 1.306                 | 3,834                 | 8.1                  | 1.089                 |
| 21-25.....                        | 3,202                 | 7.5                  | 1.169                 | 3,378                 | 7.1                  | .938                  |
| 26-30.....                        | 2,534                 | 5.9                  | 1.030                 | 2,994                 | 6.3                  | .762                  |
| 31-40.....                        | 5,090                 | 11.9                 | .796                  | 6,070                 | 12.8                 | .622                  |
| 41-50.....                        | 2,555                 | 6.0                  | .630                  | 3,824                 | 8.1                  | .549                  |
| 51-67.....                        | 4,649                 | 10.8                 | .494                  | 5,755                 | 12.1                 | .446                  |
| 68 & Over.....                    | 20,394                | 47.6                 | .298                  | 20,768                | 43.7                 | .271                  |
| Sea Bobs.....                     | 526                   | 1.2                  | .196                  | 182                   | .4                   | .224                  |
| <b>TOTAL.....</b>                 | <b>42,824</b>         | <b>100.0</b>         | <b>.598</b>           | <b>47,499</b>         | <b>100.0</b>         | <b>.517</b>           |

**Exhibit 10**  
**SHRIMP PRODUCTION AND NUMBER**  
**OF TRAWLS AND/OR SEINES—1913-1968**

| Calendar<br>Year | Barrels<br>Shrimp<br>(210 lbs.) | No. of<br>Seines | No. of<br>Trawls |
|------------------|---------------------------------|------------------|------------------|
| 1913.....        | 50,000                          | 131              | .....            |
| 1914.....        | 52,381                          | 131              | .....            |
| 1915.....        | 57,143                          | 268              | .....            |
| 1916.....        | 85,714                          | ....             | .....            |
| 1917.....        | 57,143                          | ....             | .....            |
| 1918.....        | 71,429                          | 300              | 17               |
| 1919.....        | 76,190                          | ....             | .....            |
| 1920.....        | 152,381                         | 97               | 499              |
| 1921.....        | 163,012                         | 135              | 983              |
| 1922.....        | 109,050                         | 111              | 699              |
| 1923.....        | 153,749                         | 128              | 1,021            |
| 1924.....        | 150,624                         | 143              | 905              |
| 1925.....        | 154,722                         | 180              | 1,010            |
| 1926.....        | 123,967                         | 143              | 692              |
| 1927.....        | 150,896                         | 120              | 913              |
| 1928.....        | 195,303                         | 261              | 1,454            |
| 1929.....        | 210,033                         | 125              | 1,486            |
| 1930.....        | 197,550                         | 172              | 1,176            |
| 1931.....        | 178,815                         | 126              | 1,131            |
| 1932.....        | 152,373                         | 66               | 699              |
| 1933.....        | 166,058                         | 67               | 1,045            |
| 1934.....        | 226,576                         | 107              | 1,441            |
| 1935.....        | 252,981                         | 125              | 1,433            |
| 1936.....        | 286,749                         | 30               | 1,920            |
| 1937.....        | 362,942                         | 35               | 2,313            |
| 1938.....        | 363,656                         | 13               | 1,662            |
| 1939.....        | 395,050                         | 26               | 1,621            |
| 1940.....        | 397,189                         | 5                | 3,016            |
| 1941.....        | 554,354                         | 5                | 3,028            |
| 1942.....        | 489,173                         | 4                | 2,380            |
| 1943.....        | 441,445                         | 4                | 2,101            |
| 1944.....        | 544,378                         | 4                | 1,866            |
| 1945.....        | 495,994                         | 4                | 2,373            |
| 1946.....        | 464,981                         | 4                | 3,030            |
| 1947.....        | 365,617                         | 4                | 3,408            |
| 1948.....        | 376,695                         | 4                | 3,200            |
| 1949.....        | 376,040                         | 4                | 3,310            |
| 1950.....        | 361,365                         | 3                | 2,819            |
| 1951.....        | 396,980                         | ....             | 2,248            |
| 1952.....        | 398,952                         | ....             | 2,277            |
| 1953.....        | 437,340                         | 10               | 3,543            |
| 1954.....        | 451,647                         | 4                | 3,442            |
| 1955.....        | 365,542                         | 5                | 3,276            |
| 1956.....        | 318,130                         | 7                | 3,072            |
| 1957.....        | 181,061                         | 9                | 2,419            |
| 1958.....        | 208,586                         | 9                | 4,400            |
| 1959.....        | 254,438                         | 8                | 4,154            |
| 1960.....        | 306,774                         | 7                | 4,896            |
| 1961.....        | 148,423                         | 8                | 4,577            |
| 1962.....        | 208,920                         | ....             | 5,453            |
| 1963.....        | 384,828                         | ....             | 7,025            |
| 1964.....        | 282,852                         | ....             | 7,397            |
| 1965.....        | 297,993                         | 8                | 7,296            |
| 1966.....        | 296,520                         | 21               | 7,215            |
| 1967.....        | 358,571                         | 29               | 9,089            |
| 1968.....        | 322,702                         | 37               | 8,996            |

**Exhibit 11**

**COMPARATIVE STATEMENT OF FRESH AND SALT WATER COMMERCIAL FISH  
PRODUCED BY LOUISIANA FISHERMEN**

| FRESH WATER FISHERIES                   | 1968               |                       | 1967               |                       |
|-----------------------------------------|--------------------|-----------------------|--------------------|-----------------------|
|                                         | Pounds             | Value to<br>Fishermen | Pounds             | Value to<br>Fishermen |
| Bowfin.....                             | 34,094             | \$ 1,821              | 51,800             | \$ 2,695              |
| Buffalofish.....                        | 1,939,942          | 255,827               | 2,062,400          | 269,711               |
| Carp.....                               | 135,095            | 3,985                 | 123,200            | 7,436                 |
| Catfish and Bullheads.....              | 4,236,202          | 1,213,633             | 4,576,600          | 1,276,106             |
| Garfish.....                            | 647,256            | 49,612                | 892,600            | 67,586                |
| Paddlefish (Spoonbill).....             | 21,404             | 1,219                 | 16,700             | 1,552                 |
| Sheepshead (Gaspergou).....             | 613,673            | 65,657                | 474,500            | 59,491                |
| Crawfish.....                           | 5,578,440          | 993,341               | 4,520,500          | 787,449               |
| Baby Green Turtles.....                 |                    |                       | 1,800              | 22,500                |
| Fresh Water Turtles.....                | 19,550             | 5,545                 | 21,200             | 4,925                 |
| Frogs.....                              | 48,508             | 28,932                | 41,700             | 19,414                |
| <b>Total Fresh Water Fisheries.....</b> | <b>13,274,164</b>  | <b>\$ 2,619,572</b>   | <b>12,783,000</b>  | <b>\$ 2,518,865</b>   |
| <b>SALT WATER FISHERIES</b>             |                    |                       |                    |                       |
| Cobia.....                              | 2,045              | \$ 171                | 3,200              | \$ 266                |
| Croaker.....                            | 90,162             | 7,185                 | 56,400             | 4,695                 |
| Drum:                                   |                    |                       |                    |                       |
| Black.....                              | 356,238            | 24,613                | 264,400            | 17,450                |
| Red (Red Fish).....                     | 740,910            | 100,920               | 653,900            | 109,136               |
| Flounder.....                           | 223,145            | 36,504                | 350,000            | 60,985                |
| Grouper.....                            | 5,138              | 371                   | 3,200              | 315                   |
| Jewfish.....                            | 200                | 16                    | 200                | 16                    |
| King Whiting (Black Mullet).....        | 419,850            | 26,114                | 687,300            | 49,682                |
| Menhaden.....                           | 623,218,600        | 7,739,602             | 510,414,000        | 6,134,338             |
| Mullet (Popeye).....                    | 17,838             | 653                   | 6,100              | 278                   |
| Pompano.....                            | 38,294             | 24,294                | 8,300              | 4,526                 |
| Sawfish.....                            | 2,353              | 159                   | 6,700              | 538                   |
| Sea Catfish.....                        | 68,875             | 6,146                 | 61,000             | 5,233                 |
| Sea Trout or Weakfish:                  |                    |                       |                    |                       |
| Spotted.....                            | 582,938            | 143,628               | 620,700            | 131,192               |
| White.....                              | 87,232             | 8,115                 | 73,600             | 7,290                 |
| Shark.....                              | 1,989              | 105                   | 7,500              | 496                   |
| Sheepshead.....                         | 161,312            | 9,068                 | 170,100            | 10,357                |
| Snapper, Red.....                       | 242,207            | 61,998                | 301,800            | 77,867                |
| Spanish Mackerel.....                   | 9,783              | 1,064                 | 7,800              | 750                   |
| Spot.....                               | 9,296              | 442                   | 9,400              | 518                   |
| Tripletail.....                         | 5,094              | 431                   | 7,000              | 670                   |
| Warsaw.....                             | 138                | 11                    | 600                | 72                    |
| Miscellaneous.....                      | 2,472,804          | 48,256                | 3,191,200          | 52,435                |
| Crabs:                                  |                    |                       |                    |                       |
| Hard.....                               | 6,626,903          | 552,869               | 7,558,700          | 519,729               |
| Soft and Peeler.....                    | 201,328            | 162,358               | 146,300            | 121,331               |
| Shrimp.....                             | 67,745,736         | 24,480,750            | 75,328,700         | 24,576,138            |
| Sea Turtles.....                        | 982                | 189                   | 2,200              | 436                   |
| Oysters.....                            | 10,380,828         | 4,103,238             | 7,742,900          | 3,413,776             |
| Squid.....                              | 512                | 67                    | 800                | 110                   |
| Terrapin.....                           | 2,094              | 854                   | 500                | 200                   |
| <b>Total Salt Water Fisheries.....</b>  | <b>713,714,824</b> | <b>\$ 37,540,191</b>  | <b>607,684,500</b> | <b>\$ 35,300,825</b>  |
| <b>GRAND TOTAL.....</b>                 | <b>726,988,980</b> | <b>\$ 40,159,763</b>  | <b>620,467,500</b> | <b>\$ 37,819,690</b>  |

Fish production figures presented were obtained in cooperation with U. S. Department of the Interior, Fish and Wild Life Service, Bureau of Commercial Fisheries.

# Exhibit 12 1968 COMMERCIAL FISHING AND DEALERS LICENSES SOLD BY PARISH, STATE AND CLASS

| Parish                | S. W. Shrimp Trawl Vessel | S. W. Fish Vessel | Menhaden Seine & Vessel | Oyster Tonnage | Oyster Dredging | Oyster Shop—Resale | Commercial Fisherman Bait, Seller | Hoop Net | F. W. Seine | F. W. Trammel Net | F. W. Gill Net | Fish Farmer | S. W. Seine | S. W. Trammel Net | Retail Dealer | Wholesale Dealer | Wholesale Dealer Agent | Total Licenses Sold | Total Revenue |
|-----------------------|---------------------------|-------------------|-------------------------|----------------|-----------------|--------------------|-----------------------------------|----------|-------------|-------------------|----------------|-------------|-------------|-------------------|---------------|------------------|------------------------|---------------------|---------------|
| Acadia.....           | 113                       |                   |                         | 3              |                 |                    | 11                                | 19       | 42          | 4                 | 143            | 5           | 11          | 1                 | 72            | 2                | 2                      | 428                 | 3,743         |
| Allen.....            | 8                         |                   |                         | 1              |                 |                    | 4                                 | 32       | 4           | 17                | 15             | 3           |             |                   | 33            |                  |                        | 117                 | 781           |
| Ascension.....        | 10                        |                   |                         |                |                 |                    | 2                                 | 8        |             |                   | 5              |             |             |                   | 29            | 5                |                        | 64                  | 715           |
| Assumption.....       | 13                        |                   |                         |                |                 |                    |                                   | 44       | 1           | 8                 | 12             | 14          |             |                   | 29            | 9                | 3                      | 133                 | 1,475         |
| Avoyelles.....        | 2                         |                   |                         |                |                 |                    | 5                                 | 54       | 3           | 23                | 85             |             |             |                   | 56            | 4                |                        | 232                 | 2,055         |
| Beauregard.....       | 18                        |                   |                         | 1              |                 |                    | 12                                | 34       |             | 2                 | 53             |             |             |                   | 32            | 2                |                        | 155                 | 1,231         |
| Bienville.....        |                           |                   |                         |                |                 |                    | 3                                 | 10       |             | 7                 | 27             | 7           |             |                   | 31            |                  |                        | 85                  | 640           |
| Bossier.....          | 3                         |                   |                         |                |                 |                    | 2                                 | 11       | 1           | 12                | 62             |             |             |                   | 50            |                  |                        | 141                 | 1,050         |
| Caddo.....            | 3                         |                   |                         |                |                 |                    | 17                                | 20       | 6           | 25                | 106            | 1           |             |                   | 168           | 8                |                        | 354                 | 2,605         |
| Calcasieu.....        | 668                       | 8                 | 7                       | 36             |                 |                    | 31                                | 61       | 42          | 9                 | 251            | 3           | 40          | 9                 | 138           | 5                |                        | 1,308               | 16,508        |
| Caldwell.....         | 1                         |                   |                         | 1              |                 |                    | 3                                 | 18       | 1           | 24                | 50             |             |             |                   | 16            |                  |                        | 114                 | 671           |
| Cameron.....          | 219                       | 4                 |                         | 78             |                 | 1                  | 25                                | 6        | 6           | 43                | 90             | 2           | 8           | 2                 | 21            | 5                | 1                      | 407                 | 5,449         |
| Catahoula.....        |                           |                   |                         |                |                 |                    | 9                                 | 72       | 6           | 1                 | 37             |             |             |                   | 12            | 6                | 2                      | 242                 | 2,375         |
| Clabornae.....        |                           |                   |                         |                |                 |                    | 1                                 | 4        |             | 35                | 58             | 1           |             |                   | 13            |                  |                        | 28                  | 160           |
| Concordia.....        | 1                         |                   |                         |                |                 |                    | 8                                 | 70       | 1           |                   |                |             |             |                   | 23            |                  |                        | 197                 | 1,645         |
| DeSoto.....           |                           |                   |                         |                |                 |                    | 9                                 | 24       |             | 5                 | 42             |             |             |                   | 16            |                  |                        | 96                  | 590           |
| East Baton Rouge..... | 35                        | 1                 |                         |                |                 | 1                  | 19                                | 55       | 5           | 11                | 50             | 3           | 1           | 1                 | 130           | 12               |                        | 324                 | 2,780         |
| East Carroll.....     |                           |                   |                         |                |                 |                    | 5                                 | 17       | 1           | 25                | 65             | 3           |             | 1                 | 29            |                  |                        | 146                 | 1,100         |
| East Feliciana.....   | 1                         |                   |                         |                |                 |                    |                                   | 3        | 1           | 3                 |                |             |             |                   | 9             |                  |                        | 17                  | 100           |
| Evangeline.....       | 32                        | 2                 |                         |                |                 |                    | 8                                 | 40       | 19          | 43                | 83             | 2           | 4           |                   | 97            |                  |                        | 330                 | 2,165         |
| Franklin.....         | 1                         |                   |                         |                |                 |                    | 4                                 | 36       | 7           | 100               | 146            | 2           |             |                   | 16            | 1                |                        | 313                 | 2,390         |
| Grant.....            |                           |                   |                         |                |                 |                    | 13                                | 14       | 1           | 9                 | 34             | 1           |             |                   | 17            |                  |                        | 89                  | 615           |
| Iberia.....           | 326                       | 1                 |                         | 1              |                 |                    | 22                                | 27       | 2           |                   | 44             |             |             |                   | 71            | 4                | 1                      | 513                 | 7,296         |
| Iberville.....        | 6                         |                   |                         |                |                 |                    | 6                                 | 124      |             | 7                 | 22             | 3           |             |                   | 33            | 7                | 2                      | 210                 | 1,730         |
| Jackson.....          |                           |                   |                         |                |                 |                    | 5                                 | 3        | 2           | 3                 | 20             | 5           |             |                   | 29            |                  |                        | 68                  | 465           |
| Jefferson.....        | 1,188                     | 1                 |                         | 8              | 1               | 29                 | 14                                | 5        |             | 4                 | 19             | 1           | 4           | 13                | 172           | 28               | 2                      | 1,489               | 26,696        |
| Jefferson Davis.....  | 158                       |                   |                         | 1              |                 |                    | 6                                 | 36       | 26          | 3                 | 70             |             |             |                   | 41            | 1                |                        | 355                 | 4,181         |
| Lafayette.....        | 173                       | 1                 |                         | 2              |                 | 2                  | 2                                 | 11       | 15          | 6                 | 48             | 5           | 45          |                   | 119           |                  |                        | 431                 | 4,457         |
| Lafourche.....        | 564                       |                   |                         | 39             | 6               | 9                  | 2                                 | 5        | 1           | 1                 | 8              |             | 1           | 2                 | 47            | 15               | 6                      | 706                 | 14,342        |
| LaSalle.....          | 2                         |                   |                         |                |                 |                    | 11                                | 25       | 3           | 33                | 57             | 1           |             |                   | 27            | 1                | 5                      | 165                 | 1,330         |
| Lincoln.....          |                           |                   |                         |                |                 |                    | 5                                 | 12       |             | 5                 | 25             |             |             |                   | 20            |                  |                        | 64                  | 350           |
| Livingston.....       | 7                         |                   |                         |                |                 |                    | 2                                 | 22       |             | 1                 | 7              |             |             |                   | 31            |                  |                        | 74                  | 485           |
| Madison.....          |                           |                   |                         |                |                 |                    | 1                                 | 20       |             | 35                | 40             | 1           | 1           |                   | 12            |                  |                        | 112                 | 860           |
| Morehouse.....        |                           |                   |                         |                |                 |                    | 4                                 | 44       | 2           | 59                | 90             | 2           |             |                   | 49            |                  |                        | 230                 | 1,460         |
| Natchitoches.....     |                           |                   |                         |                |                 |                    | 4                                 | 19       | 1           | 15                | 114            | 1           |             | 1                 | 23            |                  |                        | 178                 | 1,415         |
| Orleans.....          | 371                       | 4                 | 8                       | 33             | 11              | 44                 | 54                                | 1        |             | 5                 | 13             |             | 7           | 14                | 368           | 21               | 5                      | 959                 | 12,357        |
| Ouachita.....         | 1                         |                   |                         |                |                 |                    | 18                                | 67       | 7           | 93                | 210            | 5           |             |                   | 116           | 6                |                        | 527                 | 3,575         |
| Plaquemines.....      | 539                       | 1                 | 5                       | 56             | 17              | 4                  | 11                                | 2        |             |                   | 14             |             | 1           | 35                | 25            | 5                | 5                      | 716                 | 13,907        |
| Pointe Coupee.....    |                           |                   |                         |                |                 |                    | 10                                | 18       | 3           | 1                 | 31             |             |             |                   | 20            |                  |                        | 83                  | 545           |
| Rapides.....          | 8                         |                   |                         |                |                 |                    | 20                                | 57       | 2           | 46                | 148            | 1           | 1           |                   | 124           | 4                |                        | 411                 | 2,705         |
| Red River.....        |                           |                   |                         |                |                 |                    | 6                                 | 15       |             |                   |                |             |             |                   | 21            |                  |                        | 54                  | 350           |
| Richland.....         |                           |                   |                         |                |                 |                    | 3                                 | 9        | 1           | 64                | 79             | 4           |             |                   | 21            | 1                |                        | 182                 | 1,165         |
| Sabine.....           |                           |                   |                         |                |                 |                    | 28                                | 10       |             | 9                 | 38             |             |             |                   | 53            | 2                | 1                      | 141                 | 835           |
| St. Bernard.....      | 425                       |                   |                         | 20             | 15              | 7                  | 8                                 | 1        |             |                   | 1              |             |             | 12                | 25            | 7                | 2                      | 525                 | 10,024        |
| St. Charles.....      | 143                       |                   |                         | 1              |                 | 3                  | 5                                 | 2        |             |                   | 4              | 2           |             |                   | 24            | 5                | 1                      | 193                 | 3,321         |
| St. Helena.....       |                           |                   |                         |                |                 |                    |                                   | 6        |             |                   |                |             |             |                   | 1             |                  |                        | 7                   | 35            |

# EXHIBIT 12 (Continued)

| Parish               | S. W. Shrimp<br>Trawl Vessel | S. W. Fish<br>Vessel | Menhaden<br>Seine & Vessel | Oyster<br>Tonnage | Oyster<br>Dredging | Oyster<br>Shop—Resale | Commercial<br>Fisherman<br>Bait, Seller | Hoop Net | F. W. Seine | F. W. Trammel<br>Net | F. W. Gill<br>Net | Fish Farmer | S. W. Seine | S. W. Trammel<br>Net | Retail Dealer | Wholesale<br>Dealer | Wholesale<br>Agent | Total<br>Licenses Sold | Total<br>Revenue |
|----------------------|------------------------------|----------------------|----------------------------|-------------------|--------------------|-----------------------|-----------------------------------------|----------|-------------|----------------------|-------------------|-------------|-------------|----------------------|---------------|---------------------|--------------------|------------------------|------------------|
| St. James            | 19                           |                      |                            |                   |                    |                       |                                         | 1        |             |                      |                   |             | 1           |                      | 17            | 2                   |                    | 41                     | 500              |
| St. John the Baptist | 43                           |                      |                            |                   |                    |                       | 1                                       |          |             | 2                    | 3                 |             |             |                      | 8             |                     |                    | 58                     | 840              |
| St. Landry           | 46                           | 2                    |                            |                   |                    |                       | 28                                      | 59       | 35          | 43                   | 123               |             | 4           |                      | 95            | 8                   |                    | 443                    | 3,495            |
| St. Martin           | 30                           |                      |                            |                   |                    |                       | 27                                      | 90       | 4           | 27                   | 29                | 11          | 2           | 1                    | 47            | 13                  | 9                  | 290                    | 2,765            |
| St. Mary             | 522                          | 7                    | 4                          | 1                 |                    |                       | 44                                      | 71       | 3           | 6                    | 46                |             | 5           | 2                    | 72            | 13                  | 7                  | 803                    | 14,036           |
| St. Tammany          | 50                           |                      |                            | 3                 | 1                  | 2                     | 78                                      | 20       |             | 2                    | 3                 | 1           | 2           | 8                    | 102           | 2                   |                    | 274                    | 2,346            |
| Tangipahoa           | 19                           |                      |                            | 1                 |                    | 6                     | 16                                      | 8        |             | 1                    | 3                 | 3           |             |                      | 86            | 7                   |                    | 150                    | 1,480            |
| Tensas               |                              |                      |                            |                   |                    |                       | 1                                       | 10       | 2           | 16                   | 46                | 3           |             |                      | 15            |                     |                    | 93                     | 1,010            |
| Terrebonne           | 1,621                        | 1                    | 17                         | 69                | 11                 | 14                    | 3                                       | 3        | 1           |                      | 4                 |             | 5           | 23                   | 53            | 54                  | 5                  | 1,884                  | 38,910           |
| Union                | 1                            |                      |                            |                   |                    |                       | 5                                       | 63       |             | 43                   | 74                | 2           |             |                      | 26            | 1                   |                    | 215                    | 1,490            |
| Vermilion            | 541                          | 2                    | 6                          | 5                 |                    |                       | 23                                      | 10       | 20          | 6                    | 123               | 5           | 56          | 1                    | 80            | 5                   | 1                  | 884                    | 12,050           |
| Vernon               | 1                            |                      |                            |                   |                    |                       | 28                                      | 25       |             | 3                    | 15                | 3           |             |                      | 13            |                     |                    | 88                     | 495              |
| Washington           |                              |                      |                            |                   |                    |                       | 10                                      | 24       | 2           | 1                    | 12                | 4           |             |                      | 60            | 3                   |                    | 116                    | 740              |
| Webster              | 1                            |                      |                            |                   |                    |                       | 3                                       | 21       |             | 37                   | 59                | 3           | 1           |                      | 63            |                     |                    | 188                    | 1,210            |
| West Baton Rouge     |                              |                      |                            |                   |                    |                       | 1                                       | 14       |             | 4                    | 18                |             |             |                      | 10            |                     |                    | 52                     | 340              |
| West Carroll         | 5                            |                      |                            |                   |                    |                       |                                         | 22       | 1           | 28                   | 52                | 6           |             |                      | 24            |                     | 1                  | 134                    | 830              |
| West Feliciana       | 1                            |                      |                            |                   |                    |                       |                                         | 7        | 1           | 5                    | 1                 |             |             |                      | 6             |                     |                    | 21                     | 140              |
| Winn                 |                              |                      |                            |                   |                    |                       | 8                                       | 24       |             | 7                    | 36                | 1           |             |                      | 17            |                     | 1                  | 94                     | 550              |
| TOTAL Louisiana      | 7,939                        | 35                   | 47                         | 360               | 62                 | 122                   | 714                                     | 1,665    | 277         | 1,040                | 3,183             | 127         | 227         | 128                  | 3,296         | 277                 | 62                 | 19,561                 | 247,926          |
| Alabama              | 127                          | 4                    |                            |                   |                    |                       |                                         |          |             | 1                    |                   |             |             | 7                    |               | 1                   |                    | 139                    | 5,550            |
| Arkansas             |                              |                      |                            |                   |                    |                       |                                         |          |             |                      |                   |             |             |                      |               |                     |                    |                        |                  |
| Florida              | 67                           |                      |                            |                   |                    |                       |                                         |          |             |                      |                   |             |             |                      |               |                     |                    | 67                     | 2,815            |
| Georgia              | 1                            |                      |                            |                   |                    |                       |                                         |          |             |                      |                   |             |             |                      |               |                     |                    | 1                      | 40               |
| Mississippi          | 221                          | 8                    | 18                         | 39                | 36                 |                       | 2                                       |          | 3           | 10                   | 24                |             | 2           | 20                   |               |                     | 23                 | 406                    | 12,009           |
| North Carolina       | 2                            |                      |                            |                   |                    |                       |                                         |          |             |                      |                   |             |             |                      |               |                     |                    | 2                      | 80               |
| New York             | 1                            |                      |                            |                   |                    |                       |                                         |          |             |                      |                   |             |             |                      |               |                     |                    | 1                      | 30               |
| Texas                | 638                          | 9                    |                            | 3                 |                    | 1                     | 34                                      |          | 1           | 1                    | 15                |             | 7           | 4                    | 4             | 43                  | 1                  | 721                    | 15,583           |
| TOTAL Non Resident   | 1,057                        | 21                   | 18                         | 42                | 36                 | 1                     | 36                                      |          | 4           | 12                   | 39                |             | 9           | 31                   | 4             | 4                   | 24                 | 1,338                  | 36,112           |
| 1968 Total           | 8,996                        | 56                   | 65                         | 402               | 98                 | 123                   | 750                                     | 1,665    | 281         | 1,052                | 3,222             | 127         | 236         | 159                  | 3,300         | 281                 | 86                 | 20,899                 | 284,038          |
| 1967 Total           | 9,089                        | 49                   | 74                         | 323               | 113                | 133                   | 675                                     | 1,662    | 292         | 946                  | 2,929             | 73          | 214         | 141                  | 3,198         | 283                 | 64                 | 20,258                 | 286,083          |
| INCREASE             |                              | 7                    |                            | 79                |                    |                       | 75                                      | 3        |             | 106                  | 293               | 54          | 22          | 18                   | 102           |                     | 22                 | 641                    |                  |
| DECREASE             | 93                           |                      | 9                          |                   | 15                 | 10                    |                                         |          | 11          |                      |                   |             |             |                      |               | 2                   |                    |                        | 2,045            |
| %INCREASE            |                              | 14.3%                |                            | 24.5%             |                    |                       | 11.1%                                   | .2%      |             | 11.2%                | 10.0%             | 74.0%       | 10.3%       | 12.8%                | 3.2%          |                     | 34.5%              | 3.2%                   |                  |
| %DECREASE            | 1.0%                         |                      | 12.2%                      |                   | 11.5%              | 7.5%                  |                                         |          | 38.0%       |                      |                   |             |             |                      |               | .7%                 |                    |                        | .7%              |

‡Non-Resident Wholesale Minnow Dealer.

# Exhibit 13

## 1969 COMMERCIAL FISHING AND DEALERS LICENSES SOLD BY PARISH, STATE AND CLASS

| Parish                | S. W. Shrimp Trawl Vessel | S. W. Fish Vessel | Menhaden Seine & Vessel | Oyster Tonnage | Oyster Dredging | Oyster Shop—Resale | Commercial Fisherman | Hoop Net | F. W. Seine | F. W. Trammel Net | F. W. Gill Net | Fish Farmer | S. W. Seine | S. W. Trammel Net | Retail Dealer | Wholesale Dealer | Wholesale Dealer Agent | Total Licenses Sold | Total Revenue |  |
|-----------------------|---------------------------|-------------------|-------------------------|----------------|-----------------|--------------------|----------------------|----------|-------------|-------------------|----------------|-------------|-------------|-------------------|---------------|------------------|------------------------|---------------------|---------------|--|
| Acadia.....           | 154                       | 1                 |                         | 14             |                 |                    | 5                    | 23       | 40          | 6                 | 177            | 3           | 17          |                   | 60            | 2                | 2                      | 504                 | \$ 4,520      |  |
| Allen.....            | 16                        |                   |                         | 2              |                 |                    | 3                    | 23       | 5           | 23                | 12             | 3           |             | 1                 | 31            |                  |                        | 119                 | 842           |  |
| Ascension.....        | 14                        |                   |                         |                |                 |                    | 12                   | 11       |             | 2                 | 14             | 1           |             |                   | 25            | 3                |                        | 82                  | 810           |  |
| Assumption.....       | 15                        |                   |                         |                |                 |                    | 319                  | 54       |             | 5                 | 13             | 25          |             |                   | 22            | 11               | 2                      | 466                 | 3,365         |  |
| Avoyelles.....        | 2                         |                   |                         |                |                 |                    | 8                    | 60       | 10          | 25                | 110            |             |             |                   | 59            | 4                |                        | 278                 | 2,320         |  |
| Beauregard.....       | 24                        |                   |                         | 3              |                 |                    | 12                   | 41       |             | 4                 | 56             | 3           | 1           |                   | 36            | 1                |                        | 181                 | 1,453         |  |
| Bienville.....        |                           |                   |                         |                |                 |                    | 3                    | 10       |             | 5                 | 23             | 7           |             |                   | 29            |                  |                        | 77                  | 680           |  |
| Bossier.....          | 2                         |                   |                         |                |                 |                    | 3                    | 8        |             | 15                | 75             | 2           |             |                   | 45            |                  |                        | 151                 | 1,090         |  |
| Caddo.....            | 4                         |                   |                         | 1              |                 |                    | 18                   | 21       | 1           | 27                | 91             | 2           |             |                   | 171           | 9                |                        | 349                 | 2,661         |  |
| Calcasieu.....        | 836                       | 19                | 8                       | 88             |                 |                    | 31                   | 75       | 54          | 17                | 264            | 3           | 39          | 5                 | 138           | 5                | 2                      | 1,584               | 19,754        |  |
| Caldwell.....         | 1                         |                   |                         |                |                 |                    | 1                    | 21       | 2           | 25                | 53             |             |             |                   | 14            |                  |                        | 117                 | 710           |  |
| Cameron.....          | 253                       | 7                 |                         | 110            |                 | 1                  | 38                   | 10       | 1           |                   | 33             | 2           | 8           | 2                 | 18            | 6                | 5                      | 494                 | 6,350         |  |
| Catahoula.....        |                           |                   |                         |                |                 |                    | 3                    | 86       | 5           | 70                | 90             | 3           |             |                   | 12            | 9                | 3                      | 281                 | 3,095         |  |
| Clabornie.....        |                           |                   |                         |                |                 |                    |                      | 3        |             | 1                 | 4              |             |             |                   | 15            |                  |                        | 23                  | 140           |  |
| Concordia.....        |                           |                   |                         | 1              |                 |                    | 6                    | 57       |             | 31                | 72             |             |             | 2                 | 18            |                  |                        | 187                 | 1,486         |  |
| DeSoto.....           |                           |                   |                         |                |                 |                    | 19                   | 30       |             | 1                 | 41             | 3           |             |                   | 22            | 3                |                        | 119                 | 860           |  |
| East Baton Rouge..... | 50                        |                   |                         |                |                 | 1                  | 34                   | 74       | 3           | 20                | 64             | 1           | 2           | 4                 | 144           | 9                |                        | 406                 | 3,280         |  |
| East Carroll.....     | 1                         |                   |                         |                |                 |                    | 6                    | 13       | 4           | 24                | 75             |             |             |                   | 27            | 1                |                        | 154                 | 1,230         |  |
| East Feliciana.....   | 2                         | 1                 |                         |                |                 |                    | 1                    | 4        |             |                   |                | 1           | 2           |                   | 8             |                  |                        | 20                  | 135           |  |
| Evangeline.....       | 31                        | 2                 |                         |                |                 |                    | 3                    | 39       | 11          | 59                | 91             | 1           | 5           |                   | 106           |                  |                        | 348                 | 2,170         |  |
| Franklin.....         |                           |                   |                         |                |                 |                    | 1                    | 16       |             | 113               | 143            | 2           |             |                   | 11            | 2                |                        | 313                 | 2,695         |  |
| Grant.....            |                           |                   |                         |                |                 |                    | 15                   | 37       | 1           | 3                 | 50             | 2           | 6           | 3                 | 26            |                  |                        | 111                 | 700           |  |
| Iberia.....           | 363                       | 2                 |                         |                |                 | 1                  | 177                  | 137      | 1           | 14                | 25             | 2           | 1           |                   | 35            | 4                | 1                      | 578                 | 8,045         |  |
| Iberville.....        | 5                         |                   |                         |                |                 |                    |                      | 4        |             | 8                 | 22             | 7           |             |                   | 27            | 1                |                        | 74                  | 510           |  |
| Jackson.....          | 1                         |                   |                         |                |                 |                    | 4                    | 4        |             | 5                 | 30             |             | 9           | 15                | 169           | 30               | 2                      | 1,671               | 29,722        |  |
| Jefferson.....        | 1,312                     | 5                 |                         | 13             | 5               | 35                 | 35                   | 6        |             | 3                 | 72             |             | 12          |                   | 49            |                  |                        | 402                 | 4,729         |  |
| Jefferson Davis.....  | 180                       |                   |                         | 4              |                 | 8                  | 8                    | 48       | 24          | 3                 | 83             | 2           | 58          | 2                 | 107           | 2                |                        | 528                 | 3,745         |  |
| Lafayette.....        | 231                       | 2                 |                         | 10             |                 |                    | 1                    | 5        | 22          | 3                 | 14             | 2           | 1           | 8                 | 55            | 18               | 2                      | 933                 | 18,515        |  |
| LaFourche.....        | 739                       |                   |                         | 50             | 14              | 14                 | 3                    | 7        | 4           | 2                 | 59             | 1           |             |                   | 21            |                  |                        | 173                 | 1,365         |  |
| LaSalle.....          | 3                         |                   |                         |                |                 |                    | 8                    | 36       | 5           | 40                | 11             |             |             |                   | 34            |                  |                        | 63                  | 375           |  |
| Lincoln.....          |                           |                   |                         |                |                 |                    | 13                   | 13       |             | 4                 | 11             | 1           |             | 1                 | 37            |                  |                        | 96                  | 610           |  |
| Livingston.....       | 7                         |                   |                         |                |                 |                    | 13                   | 33       |             | 1                 | 4              | 1           |             |                   | 9             |                  |                        | 123                 | 910           |  |
| Madison.....          |                           |                   |                         |                |                 |                    | 10                   | 19       | 1           | 39                | 53             | 1           |             | 1                 | 48            |                  |                        | 298                 | 1,960         |  |
| Morehouse.....        |                           |                   |                         |                |                 |                    | 4                    | 46       | 4           | 68                | 118            | 4           |             |                   | 20            |                  |                        | 183                 | 1,455         |  |
| Natchitoches.....     |                           |                   |                         |                |                 |                    | 82                   | 24       | 3           | 26                | 105            | 1           |             |                   | 319           | 17               | 3                      | 982                 | 12,787        |  |
| Orleans.....          | 392                       | 2                 | 7                       | 41             | 17              | 49                 | 19                   | 57       | 9           | 101               | 226            | 7           | 5           | 20                | 124           | 5                |                        | 551                 | 3,745         |  |
| Ouachita.....         | 3                         |                   |                         |                |                 |                    | 15                   | 5        |             | 3                 | 17             |             | 1           | 30                | 29            | 4                | 3                      | 798                 | 15,346        |  |
| Plaquemine.....       | 564                       | 6                 | 5                       | 77             | 36              | 3                  | 12                   | 27       | 3           | 3                 | 31             |             |             |                   | 19            |                  | 1                      | 99                  | 650           |  |
| Poite Coupee.....     | 3                         |                   |                         |                |                 |                    | 25                   | 60       | 2           | 45                | 140            | 2           | 1           |                   | 124           | 2                | 1                      | 411                 | 2,525         |  |
| Rapides.....          | 9                         |                   |                         |                |                 |                    | 3                    | 7        |             | 2                 | 12             | 5           |             |                   | 12            |                  |                        | 38                  | 255           |  |
| Red River.....        | 1                         |                   |                         |                |                 |                    | 2                    | 13       | 2           | 63                | 76             | 5           |             |                   | 22            | 1                |                        | 184                 | 1,145         |  |
| Richland.....         |                           |                   |                         |                |                 |                    | 26                   | 2        |             | 4                 | 11             |             |             |                   | 58            | 4                |                        | 105                 | 720           |  |
| Sabine.....           |                           |                   |                         |                |                 |                    | 15                   | 1        |             |                   |                |             |             |                   | 23            | 9                | 1                      | 563                 | 10,837        |  |
| St. Bernard.....      | 444                       | 3                 |                         | 25             | 21              | 9                  | 8                    | 1        |             |                   |                |             | 4           | 7                 | 24            | 6                | 1                      | 221                 | 3,654         |  |
| St. Charles.....      | 161                       |                   |                         | 1              | 1               | 1                  | 1                    | 8        |             | 3                 | 2              | 4           |             | 1                 | 1             |                  |                        | 8                   | 40            |  |
| St. Helena.....       |                           |                   |                         |                |                 |                    |                      | 7        |             |                   |                |             |             |                   |               |                  |                        |                     |               |  |

# EXHIBIT 13 (Continued)

| Parish               | S. W. Shrimp | S. W. Fish | Seine & Vessel | Oyster Tonnage | Oyster Dredging | Oyster Shop—Resale | Commercial Fisherman | Hoop Net | F. W. Seine | F. W. Trammel | F. W. Gill | Fish Farmer | S. W. Seine | S. W. Trammel | Retail Dealer | Wholesale Dealer | Wholesale Agent | Total Licenses Sold | Total Revenue |
|----------------------|--------------|------------|----------------|----------------|-----------------|--------------------|----------------------|----------|-------------|---------------|------------|-------------|-------------|---------------|---------------|------------------|-----------------|---------------------|---------------|
| St. James            | 32           |            |                |                |                 |                    | 2                    | 2        |             |               | 1          | 1           |             |               | 18            | 1                |                 | 57                  | 670           |
| St. John the Baptist | 61           |            |                |                |                 |                    | 1                    | 1        |             |               | 2          |             |             |               | 8             |                  |                 | 73                  | 1,000         |
| St. Landry           | 55           |            |                |                |                 |                    | 26                   | 65       | 33          | 49            | 157        | 2           | 8           |               | 97            | 7                |                 | 499                 | 3,800         |
| St. Martin           | 46           |            |                |                |                 |                    | 73                   | 91       | 1           | 27            | 41         | 10          | 5           | 1             | 48            | 19               | 8               | 370                 | 3,755         |
| St. Mary             | 592          | 6          | 7              | 1              |                 | 1                  | 99                   | 81       | 4           | 12            | 61         | 1           | 11          |               | 68            | 15               | 8               | 967                 | 16,081        |
| St. Tammany          | 62           |            |                | 5              | 5               | 3                  | 84                   | 17       | 2           | 2             | 6          | 6           | 3           | 8             | 112           | 3                |                 | 312                 | 2,919         |
| Tangipahoa           | 23           |            |                | 8              | 8               | 5                  | 25                   | 11       |             | 2             | 4          | 4           | 1           |               | 94            | 5                |                 | 192                 | 2,010         |
| Tensas               |              |            |                |                |                 |                    |                      | 13       | 1           | 16            | 48         | 2           |             |               | 14            |                  |                 | 94                  | 850           |
| Terrebonne           | 1,855        |            | 15             | 86             | 32              | 17                 | 6                    | 6        | 2           |               | 5          |             | 7           | 27            | 63            | 51               | 4               | 2,176               | 44,980        |
| Union                |              |            |                |                |                 |                    | 2                    | 60       |             | 37            | 53         | 2           |             |               | 21            |                  |                 | 175                 | 1,235         |
| Vermilion            | 584          | 2          | 6              | 19             |                 | 3                  | 36                   | 10       | 23          | 4             | 186        | 6           | 100         |               | 80            | 5                |                 | 1,064               | 13,929        |
| Vernon               | 3            |            |                |                |                 |                    | 39                   | 20       |             | 4             | 25         | 1           |             |               | 17            | 2                | 1               | 112                 | 735           |
| Washington           | 2            |            |                |                |                 |                    | 11                   | 21       |             | 3             | 11         | 2           | 1           |               | 58            | 2                |                 | 111                 | 685           |
| Webster              | 1            |            |                |                |                 |                    | 2                    | 19       |             | 38            | 70         | 3           |             |               | 63            |                  |                 | 196                 | 1,285         |
| West Baton Rouge     | 3            |            |                |                |                 |                    | 9                    | 8        | 1           | 1             | 13         |             |             |               | 10            |                  |                 | 45                  | 295           |
| West Carroll         | 1            |            |                |                |                 |                    | 3                    | 19       | 1           | 30            | 46         | 5           |             |               | 23            | 1                |                 | 129                 | 905           |
| West Feliciana       | 1            |            |                |                |                 |                    | 2                    | 4        |             | 7             | 2          |             |             |               | 4             |                  |                 | 20                  | 120           |
| Winn                 |              |            |                |                |                 |                    | 4                    | 24       | 1           | 9             | 42         |             |             |               | 16            |                  | 1               | 97                  | 600           |
| TOTAL LOUISIANA      | 9,144        | 58         | 48             | 559            | 139             | 143                | 1,454                | 1,786    | 302         | 1,170         | 3,499      | 149         | 308         | 138           | 3,303         | 289              | 55              | 22,544              | 284,610       |
| Alabama              | 177          | 1          |                |                |                 |                    | 1                    |          |             |               |            |             |             | 7             |               |                  |                 | 185                 | 7,680         |
| Arkansas             |              |            |                |                |                 |                    |                      |          |             |               |            |             |             |               |               |                  |                 | 1                   | 5             |
| Florida              | 47           |            |                |                |                 |                    |                      |          |             |               |            |             |             |               |               |                  |                 | 47                  | 2,035         |
| Georgia              | 1            |            |                |                |                 |                    |                      |          |             |               |            |             |             |               |               |                  |                 | 1                   | 40            |
| California           |              |            |                |                |                 |                    |                      |          |             |               |            |             |             |               |               | 1                |                 | 1                   | 50            |
| Mississippi          | 261          | 8          | 15             | 52             | 47              |                    | 2                    |          |             |               |            |             | 4           | 14            | 1             |                  |                 | 404                 | 10,853        |
| North Carolina       | 1            |            |                |                |                 |                    |                      |          |             |               |            |             |             |               |               |                  |                 | 1                   | 40            |
| Tennessee            | 1            |            |                |                |                 |                    |                      |          |             |               |            |             |             |               |               |                  |                 | 1                   | 20            |
| Texas                | 688          | 2          |                | 3              |                 |                    | 20                   | 1        |             |               | 2          | 2           | 3           | 2             |               |                  |                 | 723                 | 15,588        |
| TOTAL NON-RESIDENT   | 1,176        | 11         | 15             | 55             | 47              |                    | 23                   | 1        |             |               | 2          | 2           | 7           | 23            | 1             | 1                |                 | 1,364               | 36,311        |
| TOTAL 1969           | 10,320       | 69         | 63             | 614            | 186             | 143                | 1,477                | 1,787    | 302         | 1,170         | 3,501      | 151         | 315         | 161           | 3,304         | 290              | 55              | 23,908              | 320,922       |
| TOTAL 1968           | 8,996        | 56         | 65             | 402            | 98              | 123                | 750                  | 1,665    | 281         | 1,052         | 3,222      | 127         | 236         | 159           | 3,300         | 281              | 86              | 20,899              | 284,038       |
| Increase             | 1,324        | 13         |                | 212            | 88              | 20                 | 727                  | 122      | 21          | 118           | 279        | 24          | 79          | 2             | 4             | 9                |                 | 3,009               | 36,884        |
| Decrease             |              |            | 2              |                |                 |                    |                      |          |             |               |            |             |             |               |               |                  | 31              |                     |               |
| % Increase           | 14.7         | 23.2       |                | 52.7           | 89.8            | 16.3               | 96.9                 | 7.3      | 7.5         | 11.2          | 8.7        | 18.9        | 33.5        | 1.3           | .1            | 3.2              |                 | 14.4                | 13.0          |
| % Decrease           |              |            | 3.0            |                |                 |                    |                      |          |             |               |            |             |             |               |               |                  | 36.0            |                     |               |

## Exhibit 14

**1968 MISCELLANEOUS LICENSES  
SOLD BY PARISH, STATE, AND CLASS**

| Parish                      | Hunting<br>Club | Hunting<br>Preserve | Game<br>Breeder | Fur<br>Buyer | Fur<br>Dealer | Total<br>Licenses | Total<br>Revenue |
|-----------------------------|-----------------|---------------------|-----------------|--------------|---------------|-------------------|------------------|
| Acadia.....                 | 1               |                     | 5               |              |               | 6                 | \$ 55            |
| Allen.....                  |                 | 1                   | 2               |              |               | 3                 | 220              |
| Ascension.....              | 1               |                     | 1               |              |               | 2                 | 15               |
| Assumption.....             | 4               |                     |                 | 3            |               | 7                 | 95               |
| Avoyelles.....              | 2               |                     | 2               | 2            |               | 6                 | 80               |
| Beauregard.....             | 1               |                     | 3               |              |               | 4                 | 35               |
| Bienville.....              | 5               |                     |                 |              |               | 5                 | 25               |
| Bossier.....                | 13              |                     | 4               |              |               | 17                | 105              |
| Caddo.....                  | 8               |                     | 4               |              |               | 12                | 80               |
| Calcasieu.....              | 11              | 1                   | 12              | 1            | 1             | 26                | 550              |
| Caldwell.....               | 22              |                     | 1               |              |               | 23                | 120              |
| Cameron.....                | 1               |                     | 1               | 3            |               | 5                 | 90               |
| Catahoula.....              | 2               |                     |                 | 1            | 1             | 4                 | 185              |
| Claiborne.....              | 2               |                     |                 |              |               | 2                 | 10               |
| Concordia.....              | 8               |                     | 1               |              |               | 9                 | 50               |
| DeSoto.....                 | 1               |                     | 3               |              |               | 4                 | 35               |
| East Baton Rouge.....       | 13              | 1                   | 8               | 1            |               | 23                | 370              |
| East Carroll.....           | 16              |                     |                 |              |               | 16                | 80               |
| East Feliciana.....         | 2               |                     | 1               |              |               | 3                 | 20               |
| Evangeline.....             | 1               |                     | 5               |              |               | 6                 | 55               |
| Franklin.....               | 23              |                     |                 |              |               | 23                | 115              |
| Grant.....                  |                 |                     | 4               |              |               | 4                 | 40               |
| Iberia.....                 |                 |                     | 3               | 3            |               | 6                 | 105              |
| Iberville.....              | 20              |                     | 2               |              |               | 22                | 120              |
| Jackson.....                | 2               |                     | 3               |              |               | 5                 | 40               |
| Jefferson.....              | 5               |                     | 10              | 7            |               | 22                | 300              |
| Jefferson Davis.....        | 2               |                     | 3               | 2            |               | 7                 | 90               |
| Lafayette.....              | 3               |                     | 8               |              |               | 11                | 95               |
| Lafourche.....              | 1               |                     | 7               | 6            | 1             | 15                | 375              |
| LaSalle.....                | 2               | 1                   |                 |              |               | 3                 | 210              |
| Lincoln.....                | 4               |                     | 2               |              |               | 6                 | 40               |
| Livingston.....             | 4               |                     | 1               | 2            |               | 7                 | 80               |
| Madison.....                | 1               |                     |                 |              |               | 1                 | 5                |
| Morehouse.....              | 17              |                     |                 |              |               | 17                | 85               |
| Natchitoches.....           | 2               | 1                   | 1               |              |               | 4                 | 220              |
| Orleans.....                | 4               |                     | 6               | 3            | 6             | 19                | 1,205            |
| Onachita.....               | 31              |                     | 4               |              | 1             | 36                | 345              |
| Plaquemine.....             |                 |                     | 2               | 5            |               | 7                 | 145              |
| Pointe Coupee.....          | 4               |                     |                 |              |               | 4                 | 20               |
| Rapides.....                | 5               |                     | 6               | 1            |               | 12                | 110              |
| Red River.....              |                 |                     |                 |              |               |                   |                  |
| Richland.....               | 14              |                     |                 |              |               | 14                | 70               |
| Sabine.....                 |                 |                     |                 |              |               |                   |                  |
| St. Bernard.....            | 1               |                     | 3               | 7            |               | 11                | 210              |
| St. Charles.....            | 3               |                     | 3               | 3            | 1             | 10                | 270              |
| St. Helena.....             |                 |                     |                 |              |               |                   |                  |
| St. James.....              |                 |                     | 1               |              |               | 1                 | 10               |
| St. John.....               |                 |                     |                 |              |               |                   |                  |
| St. Landry.....             | 11              |                     | 2               |              |               | 13                | 75               |
| St. Martin.....             | 1               |                     | 1               | 1            |               | 3                 | 40               |
| St. Mary.....               | 2               |                     | 3               | 2            |               | 7                 | 90               |
| St. Tammany.....            | 1               | 1                   | 8               | 2            |               | 12                | 335              |
| Tangipahoa.....             |                 |                     | 1               | 1            |               | 2                 | 35               |
| Tensas.....                 | 14              |                     |                 | 1            |               | 15                | 95               |
| Terrebonne.....             | 2               |                     | 3               | 11           | 1             | 17                | 465              |
| Union.....                  | 3               |                     | 2               |              |               | 5                 | 35               |
| Vermilion.....              | 6               |                     | 4               | 4            | 1             | 15                | 320              |
| Vernon.....                 |                 |                     |                 |              |               |                   |                  |
| Washington.....             | 1               |                     | 3               |              |               | 4                 | 35               |
| Webster.....                | 4               |                     |                 |              | 1             | 5                 | 170              |
| West Baton Rouge.....       |                 |                     |                 |              |               |                   |                  |
| West Carroll.....           | 7               |                     | 2               |              | 1             | 10                | 205              |
| West Feliciana.....         | 4               | 1                   | 1               |              |               | 6                 | 230              |
| Winn.....                   | 1               |                     | 1               | 2            |               | 4                 | 65               |
| <b>TOTAL LOUISIANA.....</b> | <b>319</b>      | <b>7</b>            | <b>153</b>      | <b>74</b>    | <b>15</b>     | <b>568</b>        | <b>\$8,775</b>   |
| Arkansas.....               | 1               |                     |                 |              | 2             | 3                 | \$ 605           |
| Texas.....                  |                 |                     |                 | 1            | 1             | 2                 | 400              |
| <b>TOTAL.....</b>           | <b>320</b>      | <b>7</b>            | <b>153</b>      | <b>75</b>    | <b>18</b>     | <b>573</b>        | <b>\$9,780</b>   |

## Exhibit 15

**1969 MISCELLANEOUS LICENSES  
SOLD BY PARISH, STATE, AND CLASS**

| Parish                      | Hunting<br>Club | Hunting<br>Preserve | Game<br>Breeder | Fur<br>Buyer | Fur<br>Dealer | Total<br>Licenses | Total<br>Revenue |
|-----------------------------|-----------------|---------------------|-----------------|--------------|---------------|-------------------|------------------|
| Acadia.....                 | 1               |                     | 7               |              |               | 8                 | \$ 75            |
| Allen.....                  |                 |                     | 1               | 1            |               | 2                 | 35               |
| Ascension.....              |                 |                     |                 |              |               |                   |                  |
| Assumption.....             | 4               |                     |                 | 4            |               | 8                 | 120              |
| Avoyelles.....              | 2               |                     | 4               | 2            |               | 8                 | 100              |
| Beauregard.....             | 1               | 1                   | 1               | 1            |               | 4                 | 240              |
| Bienville.....              | 6               |                     |                 |              |               | 6                 | 30               |
| Bossier.....                | 13              |                     | 4               |              |               | 17                | 105              |
| Caddo.....                  | 4               |                     | 5               | 1            |               | 10                | 95               |
| Calcasieu.....              | 10              |                     | 11              | 1            | 1             | 23                | 335              |
| Caldwell.....               | 2               |                     | 1               |              |               | 3                 | 20               |
| Cameron.....                | 1               |                     | 6               | 4            |               | 11                | 165              |
| Catahoula.....              | 2               |                     | 4               | 1            | 1             | 8                 | 225              |
| Claiborne.....              |                 |                     |                 |              |               |                   |                  |
| Concordia.....              | 3               |                     | 1               | 1            |               | 5                 | 50               |
| DeSoto.....                 | 1               |                     | 4               |              |               | 5                 | 45               |
| East Baton Rouge.....       | 13              | 1                   | 8               | 1            |               | 23                | 370              |
| East Carroll.....           | 4               |                     | 1               |              |               | 5                 | 30               |
| East Feliciana.....         |                 |                     |                 |              |               |                   |                  |
| Evangeline.....             | 1               |                     | 2               |              |               | 3                 | 25               |
| Franklin.....               | 18              |                     | 3               |              |               | 21                | 120              |
| Grant.....                  |                 | 1                   | 5               |              |               | 6                 | 250              |
| Iberia.....                 | 1               |                     | 4               | 4            |               | 9                 | 145              |
| Iberville.....              | 7               |                     | 4               |              |               | 11                | 75               |
| Jackson.....                | 1               |                     | 2               |              |               | 3                 | 25               |
| Jefferson.....              | 4               |                     | 11              | 12           | 1             | 28                | 580              |
| Jefferson Davis.....        |                 |                     | 2               | 2            |               | 4                 | 70               |
| Lafayette.....              | 2               |                     | 6               |              |               | 8                 | 70               |
| Lafourche.....              |                 |                     | 13              | 7            | 1             | 21                | 455              |
| LaSalle.....                |                 |                     |                 |              |               |                   |                  |
| Lincoln.....                | 4               |                     | 3               |              |               | 7                 | 50               |
| Livingston.....             | 2               |                     | 6               | 4            |               | 12                | 170              |
| Madison.....                | 2               |                     |                 |              |               | 2                 | 10               |
| Morehouse.....              | 11              |                     | 1               |              |               | 12                | 65               |
| Natchitoches.....           |                 | 1                   |                 |              |               | 1                 | 200              |
| Orleans.....                | 5               |                     | 8               | 5            | 4             | 22                | 1,105            |
| Ouachita.....               | 27              |                     | 7               |              | 1             | 35                | 355              |
| Plaquemine.....             | 1               |                     |                 | 7            |               | 8                 | 180              |
| Pointe Coupee.....          | 2               |                     | 1               | 1            |               | 4                 | 45               |
| Rapides.....                | 6               |                     | 9               | 2            | 1             | 18                | 320              |
| Red River.....              |                 |                     |                 |              |               |                   |                  |
| Richland.....               | 12              |                     |                 | 2            |               | 14                | 110              |
| Sabine.....                 |                 |                     |                 |              |               |                   |                  |
| St. Bernard.....            |                 |                     | 3               | 9            |               | 12                | 255              |
| St. Charles.....            | 2               |                     | 3               | 1            | 1             | 7                 | 215              |
| St. Helena.....             |                 |                     | 1               |              |               | 1                 | 10               |
| St. James.....              |                 |                     |                 |              |               |                   |                  |
| St. John.....               |                 |                     | 1               |              |               | 1                 | 10               |
| St. Landry.....             | 4               |                     | 6               |              |               | 10                | 80               |
| St. Martin.....             | 1               |                     | 1               | 1            |               | 3                 | 40               |
| St. Mary.....               | 3               |                     | 2               | 7            |               | 12                | 210              |
| St. Tammany.....            | 1               | 1                   | 9               |              | 1             | 12                | 445              |
| Tangipahoa.....             |                 |                     | 4               | 2            | 1             | 7                 | 240              |
| Tensas.....                 | 21              |                     |                 | 1            |               | 22                | 130              |
| Terrebonne.....             | 1               |                     | 6               | 15           | 2             | 24                | 740              |
| Union.....                  | 1               |                     | 3               |              |               | 4                 | 35               |
| Vermilion.....              | 8               |                     | 4               | 5            | 1             | 18                | 355              |
| Vernon.....                 |                 |                     | 5               |              |               | 5                 | 50               |
| Washington.....             |                 |                     | 6               | 2            |               | 8                 | 110              |
| Webster.....                | 6               |                     | 1               |              | 1             | 8                 | 65               |
| West Baton Rouge.....       | 1               |                     |                 |              |               | 1                 | 5                |
| West Carroll.....           | 2               |                     | 6               |              | 1             | 9                 | 220              |
| West Feliciana.....         | 10              | 1                   |                 |              |               | 11                | 250              |
| Winn.....                   |                 |                     | 2               | 2            |               | 4                 | 70               |
| <b>TOTAL LOUISIANA.....</b> | <b>234</b>      | <b>6</b>            | <b>208</b>      | <b>109</b>   | <b>17</b>     | <b>574</b>        | <b>\$10,000</b>  |
| Arkansas.....               |                 |                     |                 |              | 2             | 2                 | \$ 600           |
| Texas.....                  |                 |                     |                 |              | 1             | 1                 | 300              |
| <b>TOTAL.....</b>           | <b>234</b>      | <b>6</b>            | <b>208</b>      | <b>109</b>   | <b>20</b>     | <b>577</b>        | <b>\$10,900</b>  |

## Exhibit 16

**NUMBER OF HUNTING LICENSES SOLD  
SEASONS 1939-1940 THROUGH 1968-69**

| Season       | Total<br>Licenses | Resident<br>Season | N/R<br>Season | N/R<br>Trip | Big<br>Game |
|--------------|-------------------|--------------------|---------------|-------------|-------------|
| 1939-40..... | 98,167            | 93,587             | 1,335         | 3,245       | .....       |
| 1940-41..... | 116,653           | 115,336            | 166           | 1,151       | .....       |
| 1941-42..... | 146,648           | 144,349            | 495           | 1,804       | .....       |
| 1942-43..... | 119,543           | 118,300            | 163           | 1,080       | .....       |
| 1943-44..... | 94,609            | 93,334             | 181           | 1,094       | .....       |
| 1944-45..... | 124,485           | 121,767            | 407           | 2,311       | .....       |
| 1945-46..... | 162,872           | 160,795            | 409           | 1,681       | .....       |
| 1946-47..... | 170,396           | 169,652            | 744           | +           | .....       |
| 1947-48..... | 176,715           | 175,482            | 1,233         | +           | .....       |
| 1948-49..... | 222,201           | 221,702            | 499           | +           | .....       |
| 1949-50..... | 235,447           | 234,964            | 483           | 1,140       | .....       |
| 1950-51..... | 235,472           | 234,195            | 137           | 1,140       | .....       |
| 1951-52..... | 235,855           | 234,177            | 192           | 1,486       | .....       |
| 1952-53..... | 209,665           | 207,428            | 169           | 2,068       | .....       |
| 1953-54..... | 251,488           | 248,496            | ††2,992       | .....       | .....       |
| 1954-55..... | 242,456           | 239,695            | ††2,761       | .....       | .....       |
| 1955-56..... | 246,731           | 243,756            | ††2,975       | .....       | .....       |
| 1956-57..... | 287,810           | 284,844            | ††2,966       | .....       | .....       |
| 1957-58..... | 284,279           | 281,708            | ††2,571       | .....       | .....       |
| 1958-59..... | 275,622           | 272,756            | ††2,866       | .....       | .....       |
| 1959-60..... | 280,672           | 278,288            | ††2,384       | .....       | .....       |
| 1960-61..... | 317,087           | 257,438            | 528           | 2,659       | 56,462      |
| 1961-62..... | 309,367           | 247,227            | 381           | 1,748       | 60,011      |
| 1962-63..... | 332,513           | 260,862            | 367           | 1,814       | 69,470      |
| 1963-64..... | 347,680           | 266,556            | 442           | 2,755       | 77,927      |
| 1964-65..... | 366,976           | 278,500            | 431           | 3,296       | 84,749      |
| 1965-66..... | 369,866           | 276,247            | 580           | 3,958       | 89,081      |
| 1966-67..... | 394,839           | 293,858            | 651           | 5,124       | 95,206      |
| 1967-68..... | 422,383           | 311,464            | 635           | 5,695       | 104,589     |
| 1968-69..... | 442,863           | 315,447            | 513           | 6,178       | 120,725     |

†No trip licenses issued during these years.

††Non-Resident sold on a reciprocal basis. These licenses include both season and trip.

## Exhibit 17

**LICENSES SOLD BY PARISHES  
1967-68 HUNTING SEASON**

| Parish                | Basic<br>Res.<br>\$2.00 | N/R<br>Season<br>\$25.00 | N/R<br>Trip<br>\$5.00 | Big<br>Game<br>\$2.00 |
|-----------------------|-------------------------|--------------------------|-----------------------|-----------------------|
| Acadia.....           | 4,906                   | 2                        | 34                    | 256                   |
| Allen.....            | 3,599                   | 10                       | 211                   | 1,675                 |
| Ascension.....        | 3,448                   | 2                        | 1                     | 853                   |
| Assumption.....       | 1,527                   | .....                    | .....                 | 262                   |
| Avoyelles.....        | 4,711                   | .....                    | 12                    | 1,180                 |
| Beauregard.....       | 3,360                   | 13                       | 107                   | 1,623                 |
| Bienville.....        | 2,273                   | .....                    | 38                    | 1,328                 |
| Bossier.....          | 5,765                   | .....                    | 26                    | 2,790                 |
| Caddo.....            | 17,183                  | 15                       | 228                   | 7,957                 |
| Calcasieu.....        | 17,277                  | 19                       | 845                   | 3,330                 |
| Caldwell.....         | 1,811                   | 1                        | 26                    | 1,336                 |
| Cameron.....          | 1,369                   | 152                      | 749                   | 85                    |
| Catahoula.....        | 2,361                   | 2                        | 20                    | 1,408                 |
| Claiborne.....        | 1,861                   | 33                       | 87                    | 1,080                 |
| Concordia.....        | 3,784                   | 113                      | 274                   | 2,547                 |
| DeSoto.....           | 2,292                   | 11                       | 41                    | 1,065                 |
| East Baton Rouge..... | 20,523                  | 5                        | 143                   | 6,982                 |
| East Carroll.....     | 1,596                   | 12                       | 115                   | 1,172                 |
| East Feliciana.....   | 1,396                   | .....                    | 12                    | 381                   |
| Evangeline.....       | 4,207                   | .....                    | 7                     | 1,182                 |
| Franklin.....         | 3,622                   | 5                        | 43                    | 2,502                 |
| Grant.....            | 3,870                   | .....                    | 15                    | 1,390                 |
| Iberia.....           | 4,966                   | 2                        | 25                    | 432                   |
| Iberville.....        | 2,994                   | .....                    | .....                 | 1,019                 |
| Jackson.....          | 2,427                   | 3                        | 37                    | 1,603                 |
| Jefferson.....        | 13,721                  | 2                        | 19                    | 1,089                 |
| Jefferson Davis.....  | 4,566                   | 5                        | 216                   | 538                   |
| Lafayette.....        | 8,370                   | 3                        | 181                   | 896                   |
| Lafourche.....        | 7,119                   | .....                    | 14                    | 499                   |
| LaSalle.....          | 3,136                   | 1                        | 19                    | 2,072                 |
| Lincoln.....          | 3,213                   | 2                        | 30                    | 1,664                 |
| Livingston.....       | 4,598                   | .....                    | 3                     | 2,073                 |
| Madison.....          | 1,758                   | 22                       | 238                   | 1,375                 |
| Morehouse.....        | 4,916                   | 30                       | 168                   | 3,477                 |
| Natchitoches.....     | 4,485                   | 1                        | 80                    | 2,024                 |
| Orleans.....          | 15,528                  | 6                        | 159                   | 1,628                 |
| Ouachita.....         | 15,269                  | 14                       | 147                   | 9,030                 |
| Plaquemines.....      | 2,300                   | .....                    | .....                 | 175                   |
| Pointe Coupee.....    | 2,147                   | .....                    | 3                     | 831                   |
| Rapides.....          | 14,181                  | 2                        | 111                   | 5,196                 |
| Red River.....        | 1,131                   | .....                    | 28                    | 682                   |
| Richland.....         | 3,545                   | 4                        | 53                    | 2,065                 |
| Sabine.....           | 2,764                   | 10                       | 43                    | 1,495                 |
| St. Bernard.....      | 1,731                   | .....                    | 4                     | 192                   |
| St. Charles.....      | 2,509                   | .....                    | 16                    | 309                   |
| St. Helena.....       | 859                     | 2                        | .....                 | 388                   |
| St. James.....        | 1,397                   | .....                    | .....                 | 243                   |
| St. John.....         | 1,350                   | .....                    | .....                 | 248                   |
| St. Landry.....       | 8,401                   | 1                        | 22                    | 2,114                 |
| St. Martin.....       | 2,534                   | .....                    | 4                     | 247                   |
| St. Mary.....         | 5,536                   | .....                    | 29                    | 778                   |
| St. Tammany.....      | 5,716                   | 41                       | 66                    | 1,288                 |
| Tangipahoa.....       | 6,545                   | 2                        | 21                    | 1,284                 |
| Tensas.....           | 1,475                   | 8                        | 145                   | 1,251                 |
| Terrebonne.....       | 6,749                   | .....                    | 28                    | 398                   |
| Union.....            | 2,915                   | 24                       | 119                   | 2,345                 |
| Vermilion.....        | 4,889                   | 5                        | 325                   | 359                   |
| Vernon.....           | 5,101                   | 13                       | 90                    | 3,206                 |
| Washington.....       | 5,417                   | 16                       | 26                    | 1,244                 |
| Webster.....          | 4,777                   | 8                        | 67                    | 2,476                 |
| West Baton Rouge..... | 1,744                   | .....                    | 5                     | 448                   |
| West Carroll.....     | 2,511                   | 12                       | 51                    | 1,766                 |
| West Feliciana.....   | 829                     | .....                    | 25                    | 300                   |
| Winn.....             | 2,604                   | 1                        | 44                    | 1,458                 |
| TOTAL 1967-68.....    | 311,464                 | 635                      | 5,695                 | 104,589               |
| TOTAL 1966-67.....    | 293,858                 | 651                      | 5,124                 | 95,206                |
| Increase.....         | 17,606                  | .....                    | 571                   | 9,383                 |
| Decrease.....         | .....                   | 16                       | .....                 | .....                 |
| %Increase.....        | 6.0%                    | .....                    | 11.1%                 | 9.8%                  |
| %Decrease.....        | .....                   | 2.5%                     | .....                 | .....                 |

# Exhibit 18

## LICENSES SOLD BY PARISHES 1968-69 HUNTING SEASON

| Parish                    | Basic<br>Res.<br>\$2.00 | N/R<br>Season<br>\$25.00 | N/R<br>Trip<br>\$5.00 | Big<br>Game<br>\$2.00 | Trapping<br>\$2.00 |
|---------------------------|-------------------------|--------------------------|-----------------------|-----------------------|--------------------|
| Acadia.....               | 4,685                   |                          | 38                    | 435                   | 46                 |
| Allen.....                | 3,928                   | 6                        | 560                   | 1,847                 | 60                 |
| Ascension.....            | 3,727                   |                          | 6                     | 994                   | 26                 |
| Assumption.....           | 1,629                   |                          |                       | 307                   | 93                 |
| Avoyelles.....            | 4,941                   |                          | 18                    | 1,517                 | 41                 |
| Beauregard.....           | 3,639                   | 7                        | 130                   | 1,761                 | 33                 |
| Bienville.....            | 2,313                   |                          | 82                    | 1,484                 | 6                  |
| Bossier.....              | 6,274                   | 1                        | 31                    | 3,551                 | 6                  |
| Caddo.....                | 16,994                  | 11                       | 205                   | 8,864                 | 30                 |
| Calcasieu.....            | 17,436                  | 18                       | 735                   | 4,539                 | 132                |
| Caldwell.....             | 1,912                   | 1                        | 30                    | 1,436                 | 31                 |
| Cameron.....              | 1,362                   | 110                      | 620                   | 140                   | 273                |
| Catahoula.....            | 2,387                   |                          | 26                    | 1,473                 | 14                 |
| Claiborne.....            | 1,937                   | 25                       | 120                   | 1,243                 | 5                  |
| Concordia.....            | 3,948                   | 87                       | 386                   | 2,854                 | 19                 |
| DeSoto.....               | 2,306                   | 7                        | 54                    | 1,124                 | 12                 |
| East Baton Rouge.....     | 21,368                  | 3                        | 155                   | 8,661                 | 16                 |
| East Carroll.....         | 1,554                   | 22                       | 177                   | 1,273                 | 24                 |
| East Feliciana.....       | 1,578                   | 1                        | 11                    | 433                   | 4                  |
| Evangeline.....           | 4,498                   |                          | 4                     | 1,450                 | 15                 |
| Franklin.....             | 3,634                   |                          |                       | 2,483                 | 36                 |
| Grant.....                | 2,350                   |                          | 14                    | 1,380                 | 9                  |
| Iberia.....               | 4,994                   |                          | 21                    | 570                   | 38                 |
| Iberville.....            | 3,292                   |                          | 2                     | 1,222                 | 46                 |
| Jackson.....              | 2,429                   | 6                        | 82                    | 1,810                 | 22                 |
| Jefferson.....            | 13,657                  |                          | 17                    | 1,528                 | 99                 |
| Jefferson Davis.....      | 4,219                   | 5                        | 173                   | 653                   | 170                |
| Lafayette.....            | 8,266                   |                          | 134                   | 1,317                 | 3                  |
| Lafourche.....            | 7,034                   |                          | 17                    | 651                   | 238                |
| LaSalle.....              | 3,167                   |                          | 30                    | 2,187                 | 23                 |
| Lincoln.....              | 3,360                   | 3                        | 64                    | 2,074                 | 4                  |
| Livingston.....           | 5,170                   |                          | 7                     | 2,552                 | 35                 |
| Madison.....              | 1,749                   |                          |                       | 1,290                 | 44                 |
| Morehouse.....            | 4,870                   | 32                       | 244                   | 3,566                 | 32                 |
| Natchitoches.....         | 4,609                   | 4                        | 75                    | 2,135                 | 10                 |
| Orleans.....              | 14,365                  | 11                       | 178                   | 2,090                 | 265                |
| Ouachita.....             | 15,654                  | 7                        | 202                   | 9,854                 | 37                 |
| Plaquemines.....          | 2,166                   |                          | 4                     | 319                   | 139                |
| Pointe Coupee.....        | 2,259                   | 1                        |                       | 1,001                 | 11                 |
| Rapides.....              | 14,528                  | 2                        | 136                   | 6,801                 | 56                 |
| Red River.....            | 1,115                   |                          | 27                    | 701                   | 6                  |
| Richland.....             | 3,470                   | 14                       | 243                   | 2,124                 | 67                 |
| Sabine.....               | 2,881                   | 6                        | 65                    | 1,636                 | 5                  |
| St. Bernard.....          | 1,962                   |                          | 3                     | 297                   | 72                 |
| St. Charles.....          | 2,526                   |                          | 8                     | 429                   | 54                 |
| St. Helena.....           | 1,018                   |                          | 6                     | 417                   | 4                  |
| St. James.....            | 1,380                   |                          |                       | 293                   | 10                 |
| St. John the Baptist..... | 1,631                   |                          |                       | 310                   | 30                 |
| St. Landry.....           | 9,024                   | 1                        | 44                    | 2,759                 | 33                 |
| St. Martin.....           | 2,638                   |                          | 9                     | 368                   | 46                 |
| St. Mary.....             | 5,430                   |                          | 34                    | 904                   | 243                |
| St. Tammany.....          | 5,982                   | 48                       | 74                    | 1,691                 | 43                 |
| Tangipahoa.....           | 6,840                   | 7                        | 44                    | 1,448                 | 60                 |
| Tensas.....               | 1,512                   |                          |                       | 1,162                 | 29                 |
| Terrebonne.....           | 6,492                   |                          | 25                    | 570                   | 331                |
| Union.....                | 2,964                   | 18                       | 137                   | 2,450                 | 15                 |
| Vermilion.....            | 4,710                   | 2                        | 256                   | 538                   | 251                |
| Vernon.....               | 5,193                   | 15                       | 130                   | 3,166                 | 15                 |
| Washington.....           | 5,422                   | 16                       | 42                    | 1,524                 | 14                 |
| Webster.....              | 4,739                   | 7                        | 95                    | 2,843                 | 24                 |
| West Baton Rouge.....     | 2,283                   |                          | 2                     | 620                   | 4                  |
| West Carroll.....         | 2,434                   | 6                        | 79                    | 1,706                 | 27                 |
| West Feliciana.....       | 901                     | 2                        | 6                     | 336                   |                    |
| Winn.....                 | 2,712                   | 1                        | 61                    | 1,564                 | 15                 |

TOTAL 1968-69..... 315,447 513 6,178† 120,725 3,601  
TOTAL 1967-68..... 311,464 635 5,695 104,589 2,495

INCREASE..... 3,983 ..... 483 16,136 1,106  
DECREASE..... 122 .....

%INCREASE..... 1.28% ..... 8.48% 15.43% 44.33%  
%DECREASE..... 19.21% .....

†Legislative Act created reciprocal license, 200 licenses sold at \$10.00 each.

# Exhibit 19

## NUMBER OF FISHING LICENSES SOLD SEASONS 1939 THROUGH 1968-69

| Season        | Total<br>Licenses | Resident   | N/R<br>Season | N/R<br>Trip |
|---------------|-------------------|------------|---------------|-------------|
| 1939.....     | 27,096            | 12,649     | 14,447        | ††          |
| 1940.....     | 31,014            | 16,140     | 14,874        | ††          |
| 1941.....     | 52,695            | 38,080     | 14,615†       | ††          |
| 1942.....     | 41,661            | 30,608     | 11,053†       | .....       |
| 1943.....     | 36,112            | 29,492     | 3,332         | 3,288       |
| 1944.....     | 33,239            | 25,755     | 3,743         | 3,741       |
| 1945.....     | 35,002            | 27,000     | 4,088         | 3,914       |
| 1946.....     | 52,909            | 42,621     | 5,808         | 4,480       |
| 1947.....     | 64,055            | 59,353     | 4,702         | ††          |
| 1948.....     | 66,797            | 63,657     | 3,140         | ††          |
| 1949.....     | 82,942            | 72,397     | 5,970         | † 4,575     |
| 1950.....     | 83,068            | 72,044     | 5,872         | † 5,152     |
| 1951.....     | 89,337            | 76,516     | 6,477         | † 6,344     |
| 1952.....     | 102,715           | 89,159     | 6,207         | † 7,349     |
| 1953.....     | 205,049           | 178,994    | 10,087        | 15,968      |
| 1954.....     | 217,282           | 187,832    | 12,048        | 17,402      |
| 1955.....     | 220,835           | 187,466    | 13,917        | 19,452      |
| 1956.....     | 218,757           | 186,106    | 14,817        | 17,834      |
| 1957.....     | 188,874           | 159,664    | 14,124        | 15,086      |
| 1958.....     | 192,290           | 165,566    | 13,364        | 13,360      |
| 1959.....     | 179,820           | 155,074    | 14,736        | 10,010      |
| 1960.....     | 153,848           | 134,231    | 10,519        | 9,098       |
| 1960-61†..... | 139,899           | 127,198    | 4,913         | 7,788       |
| 1961-62.....  | 224,601           | 202,297    | 8,508         | 13,796      |
| 1962-63.....  | 220,335           | 196,419    | 9,064         | 14,852      |
| 1963-64.....  | 204,224           | 183,320    | 8,556         | 12,348      |
| 1964-65.....  | 217,192           | 196,138    | 8,779         | 12,275      |
| 1965-66.....  | 232,294           | 208,279    | 9,778         | 14,237      |
| 1966-67.....  | 106,673           | 85,050††   | 10,452        | 11,171      |
| 1967-68.....  | 293,088           | 276,380    | 6,574         | 10,134      |
| 1968-69.....  | 139,733           | 124,026††† | 5,917         | 9,790       |

†Includes both annual and 7-day trip.

††No 7-day trip licenses issued during these years.

†Licenses issued on fiscal year basis starting with 1960-61 Season.

††Decrease due to 1966-67 being the last year for licenses issued

covering a two year period starting 1965-66 ending 1966-67.

The total valid licenses during the 1966-67 fiscal year was 293,329.

†††Legislative Act changed \$2.00 license for two year period to  
\$1.00 for one year period in mid-season.

## Exhibit 20

LICENSES SOLD BY PARISHES  
1967-68 FISHING SEASON

| Parish                | Basic<br>Res.<br>\$2.00 | N/R<br>Season<br>\$5.00 | N/R<br>Trip<br>\$2.00 | Trapping<br>\$2.00 |
|-----------------------|-------------------------|-------------------------|-----------------------|--------------------|
| Acadia.....           | 2,127                   | 3                       | 6                     | 47                 |
| Allen.....            | 2,169                   |                         | 38                    | 43                 |
| Ascension.....        | 2,897                   | 60                      | 50                    | 14                 |
| Assumption.....       | 611                     |                         | 4                     | 38                 |
| Avoyelles.....        | 2,749                   | 18                      | 146                   | 24                 |
| Beauregard.....       | 3,515                   | 8                       | 99                    | 27                 |
| Bienville.....        | 1,581                   | 11                      | 109                   | 2                  |
| Bossier.....          | 6,811                   | 42                      | 256                   | 5                  |
| Caddo.....            | 20,702                  | 87                      | 557                   | 27                 |
| Calcasieu.....        | 18,588                  | 45                      | 320                   | 92                 |
| Caldwell.....         | 613                     | 4                       | 26                    | 23                 |
| Cameron.....          | 8,298                   | 13                      | 107                   | 222                |
| Catahoula.....        | 1,083                   | 79                      | 181                   | 11                 |
| Claiborne.....        | 1,640                   | 147                     | 112                   | 5                  |
| Concordia.....        | 2,020                   | 1,632                   | 1,417                 | 12                 |
| DeSoto.....           | 1,377                   | 1                       | 27                    | 9                  |
| East Baton Rouge..... | 21,002                  | 54                      | 315                   | 15                 |
| East Carroll.....     | 582                     | 378                     | 196                   | 24                 |
| East Feliciana.....   | 404                     | 3                       | 9                     | 2                  |
| Evangeline.....       | 2,669                   | 9                       | 42                    | 15                 |
| Franklin.....         | 1,120                   | 4                       | 39                    | 31                 |
| Graaf.....            | 2,008                   | 18                      | 68                    | 15                 |
| Iberia.....           | 5,089                   |                         | 72                    | 24                 |
| Iberville.....        | 2,604                   | 9                       | 19                    | 33                 |
| Jackson.....          | 955                     | 8                       | 39                    | 19                 |
| Jefferson.....        | 19,167                  | 17                      | 89                    | 55                 |
| Jefferson Davis.....  | 2,722                   | 7                       | 31                    | 147                |
| Lafayette.....        | 5,869                   |                         | 124                   |                    |
| Lafourche.....        | 4,080                   |                         | 6                     | 158                |
| LaSalle.....          | 1,669                   | 18                      | 73                    | 14                 |
| Lincoln.....          | 1,701                   | 14                      | 44                    | 3                  |
| Livingston.....       | 2,796                   | 4                       | 51                    | 22                 |
| Madison.....          | 517                     | 70                      | 80                    | 33                 |
| Morehouse.....        | 2,484                   | 450                     | 352                   | 32                 |
| Natchitoches.....     | 4,595                   | 56                      | 425                   | 16                 |
| Orleans.....          | 25,450                  | 335                     | 335                   | 121                |
| Ouachita.....         | 7,356                   | 42                      | 340                   | 35                 |
| Plaquemine.....       | 2,211                   |                         | 3                     | 84                 |
| Pointe Coupee.....    | 2,334                   | 11                      | 87                    | 3                  |
| Rapides.....          | 14,306                  | 26                      | 311                   | 35                 |
| Red River.....        | 662                     | 3                       | 14                    | 7                  |
| Richland.....         | 1,158                   | 5                       | 45                    | 43                 |
| Sabine.....           | 2,601                   | 2                       | 25                    | 5                  |
| St. Bernard.....      | 4,433                   | 12                      | 7                     | 36                 |
| St. Charles.....      | 2,190                   | 5                       | 30                    | 39                 |
| St. Helena.....       | 182                     |                         | 2                     | 9                  |
| St. James.....        | 852                     |                         | 5                     | 8                  |
| St. John.....         | 1,347                   | 10                      | 12                    | 17                 |
| St. Landry.....       | 5,559                   | 12                      | 32                    | 15                 |
| St. Martin.....       | 2,852                   | 7                       | 73                    | 24                 |
| St. Mary.....         | 3,376                   | 13                      | 73                    | 161                |
| St. Tammany.....      | 7,817                   | 870                     | 498                   | 18                 |
| Tangipahoa.....       | 4,057                   | 101                     | 127                   | 41                 |
| Texas.....            | 793                     | 180                     | 625                   | 18                 |
| Terrebonne.....       | 5,510                   | 4                       | 30                    | 211                |
| Union.....            | 1,998                   | 1,352                   | 705                   | 10                 |
| Vermilion.....        | 2,616                   |                         | 7                     | 185                |
| Vernon.....           | 7,756                   | 27                      | 218                   | 15                 |
| Washington.....       | 3,020                   | 228                     | 185                   | 27                 |
| Webster.....          | 2,928                   | 30                      | 155                   | 30                 |
| West Baton Rouge..... | 1,775                   | 2                       | 4                     | 7                  |
| West Carroll.....     | 437                     | 12                      | 44                    | 22                 |
| West Feliciana.....   | 204                     | 5                       | 18                    |                    |
| Winn.....             | 1,786                   | 11                      | 251                   | 10                 |
| TOTAL 1967-68.....    | 276,380                 | 6,574                   | 9,790                 | 2,495              |
| TOTAL 1966-67.....    | 85,050                  | 10,452                  | 11,171                | 3,592              |
| Increase†.....        | 191,330                 |                         |                       |                    |
| Decrease.....         |                         | 3,878                   | 1,381                 | 1,097              |
| % Increase.....       | 225.0%                  |                         |                       |                    |
| % Decrease.....       |                         | 37.1%                   | 12.4%                 | 30.5%              |

†Increase due to 1966-67 being the last year for licenses issued covering a two year period starting 1965-66 ending 1966-67. The total valid licenses during the 1966-67 fiscal year was 293,329.

## Exhibit 21

LICENSES SOLD BY PARISHES  
1968-69 FISHING SEASON

| Parish                    | Resident  |         | N/R<br>Season | N/R<br>Trip |
|---------------------------|-----------|---------|---------------|-------------|
|                           | \$2.00    | \$1.00  | \$5.00        | \$2.00      |
| Acadian.....              | 319       | 599     | 3             | 15          |
| Allen.....                | 200       | 754     | 3             | 25          |
| Ascension.....            | 379       | 642     | 22            | 43          |
| Assumption.....           | 79        | 226     |               | 5           |
| Avoyelles.....            | 338       | 702     | 5             | 122         |
| Beauregard.....           | 742       | 1,507   | 13            | 120         |
| Bienville.....            | 165       | 349     | 4             | 99          |
| Bossier.....              | 1,181     | 2,424   | 45            | 242         |
| Caddo.....                | 2,401     | 5,131   | 56            | 530         |
| Calcasieu.....            | 3,596     | 5,178   | 42            | 281         |
| Caldwell.....             | 105       | 136     | 5             | 15          |
| Cameron.....              | 1,145     | 1,650   | 7             | 112         |
| Catahoula.....            | 395       | 14      | 73            | 196         |
| Claiborne.....            | 269       | 484     | 256           | 210         |
| Concordia.....            | 402       | 423     | 1,643         | 1,406       |
| DeSoto.....               | 388       | 923     | 9             | 80          |
| East Baton Rouge.....     | 3,686     | 4,087   | 38            | 399         |
| East Carroll.....         | 152       | 193     | 185           | 152         |
| East Feliciana.....       | 49        | 125     | 5             | 8           |
| Evangeline.....           | 306       | 718     | 8             | 36          |
| Franklin.....             | 198       | 273     | 3             | 37          |
| Grant.....                | 302       | 426     | 9             | 65          |
| Iberia.....               | 733       | 1,358   | 2             | 70          |
| Iberville.....            | 358       | 773     | 6             | 11          |
| Jackson.....              | 143       | 270     | 11            | 39          |
| Jefferson.....            | 2,689     | 3,981   | 18            | 55          |
| Jefferson Davis.....      | 333       | 812     | 3             | 25          |
| Lafayette.....            | 754       | 1,644   | 1             | 112         |
| Lafourche.....            | 651       | 1,001   |               | 3           |
| LaSalle.....              | 591       | 157     | 35            | 107         |
| Lincoln.....              | 235       | 585     | 19            | 56          |
| Livingston.....           | 391       | 411     | 6             | 26          |
| Madison.....              | 72        | 104     | 94            | 78          |
| Morehouse.....            | 834       | 268     | 316           | 388         |
| Natchitoches.....         | 903       | 1,291   | 32            | 365         |
| Orleans.....              | 2,476     | 14,872  | 195           | 337         |
| Ouachita.....             | 1,701     | 1,959   | 44            | 385         |
| Plaquemine.....           | 258       | 450     |               |             |
| Pointe Coupee.....        | 209       | 494     | 5             | 69          |
| Rapides.....              | 1,669     | 3,822   | 39            | 306         |
| Red River.....            | 121       | 219     | 2             | 16          |
| Richland.....             | 221       | 312     | 6             | 73          |
| Sabine.....               | 1,299     | 3,725   | 11            | 625         |
| St. Bernard.....          | 988       | 813     | 5             | 14          |
| St. Charles.....          | 278       | 614     | 5             | 19          |
| St. Helena.....           | 24        | 52      |               | 2           |
| St. James.....            | 67        | 151     |               |             |
| St. John the Baptist..... | 196       | 337     | 7             | 24          |
| St. Landry.....           | 671       | 1,392   | 8             | 25          |
| St. Martin.....           | 569       | 659     | 3             | 56          |
| St. Mary.....             | 399       | 857     | 5             | 64          |
| St. Tammany.....          | 1,929     | 748     | 918           | 528         |
| Tangipahoa.....           | 656       | 966     | 68            | 120         |
| Texas.....                | 141       | 111     | 163           | 573         |
| Terrebonne.....           | 502       | 1,318   | 10            | 21          |
| Union.....                | 574       | 630     | 1,117         | 528         |
| Vermilion.....            | 7         | 548     | 5             | 7           |
| Vernon.....               | 1,072     | 3,565   | 22            | 262         |
| Washington.....           | 683       | 583     | 202           | 139         |
| Webster.....              | 580       | 925     | 45            | 207         |
| West Baton Rouge.....     | 300       | 558     | 9             | 26          |
| West Carroll.....         | 97        | 108     | 16            | 44          |
| West Feliciana.....       | 10        | 58      | 5             | 8           |
| Winn.....                 | 119       | 261     | 25            | 123         |
| SUB-TOTAL.....            | 43,300†   | 80,726† |               |             |
| TOTAL 1968-69.....        | 124,026   |         | 5,917         | 10,134      |
| TOTAL 1967-68.....        | 276,380   |         | 6,574         | 9,790       |
| INCREASE.....             |           |         |               | 344         |
| DECREASE.....             | 152,354†† |         | 657           |             |
| % INCREASE.....           |           |         |               | 3.51%       |
| % DECREASE.....           | 55.12%    |         | 9.99%         |             |

†Legislative Act changed \$2.00 license for two year period to \$1.00 fee for one year in mid-season.

††Decrease due to 1968-69 being the last year for licenses issued covering a two year period compared with 1967-68 which was the first year for two year licenses for the 1967-69 period. Total valid licenses during the 1968-69 period was 400,406.

**Exhibit 22**

**REPORT OF CERTIFICATES OF NUMBER ISSUED TO MOTORBOATS**  
**Certificates of Number Issued During Period January 1, 1968-December 31, 1968**

| Hull Material     | Under 16 ft. |               | 16 to Less Than 26 ft. |              | 26 to Less Than 40 ft. |            | 40-65 ft. |           | Over 65 ft. |              | Total        |               |
|-------------------|--------------|---------------|------------------------|--------------|------------------------|------------|-----------|-----------|-------------|--------------|--------------|---------------|
|                   | Inboard      | Outboard      | Inboard                | Outboard     | Inboard                | Outboard   | Inboard   | Outboard  | Inboard     | Outboard     | Inboard      | Outboard      |
| Wood.....         | 63           | 2,633         | 839                    | 1,639        | 295                    | 32         | 24        | 4         | .....       | .....        | 1,221        | 4,308         |
| Steel.....        | 1            | 16            | 22                     | 57           | 41                     | 39         | 14        | 12        | 4           | .....        | 82           | 124           |
| Aluminum.....     | 27           | 3,318         | 45                     | 606          | 39                     | 49         | 2         | 1         | .....       | .....        | 113          | 3,974         |
| Plastic.....      | 21           | 3,375         | 450                    | 2,661        | 64                     | 28         | 9         | 4         | .....       | .....        | 544          | 6,068         |
| Other.....        | 10           | 2,172         | 34                     | 620          | 2                      | 19         | 1         | 3         | .....       | .....        | 47           | 2,814         |
| <b>TOTAL.....</b> | <b>122</b>   | <b>11,514</b> | <b>1,390</b>           | <b>5,583</b> | <b>441</b>             | <b>167</b> | <b>50</b> | <b>24</b> | <b>4</b>    | <b>.....</b> | <b>2,007</b> | <b>17,288</b> |

**State Certificates of Number Cancelled and Withdrawn During Period**

|                   |           |              |            |              |            |           |           |          |          |              |            |              |
|-------------------|-----------|--------------|------------|--------------|------------|-----------|-----------|----------|----------|--------------|------------|--------------|
| Wood.....         | 33        | 2,067        | 446        | 1,055        | 179        | 18        | 17        | .....    | 1        | .....        | 676        | 3,140        |
| Steel.....        | 2         | 11           | 13         | 54           | 46         | 25        | 9         | 2        | 1        | .....        | 71         | 92           |
| Aluminum.....     | 5         | 898          | 8          | 139          | 4          | 5         | 1         | .....    | .....    | .....        | 18         | 1,042        |
| Plastic.....      | 3         | 796          | 70         | 516          | 14         | 1         | 1         | .....    | .....    | .....        | 88         | 1,313        |
| Other.....        | 2         | 245          | 7          | 150          | 4          | 2         | .....     | .....    | .....    | .....        | 13         | 397          |
| <b>TOTAL.....</b> | <b>45</b> | <b>4,017</b> | <b>544</b> | <b>1,914</b> | <b>247</b> | <b>51</b> | <b>28</b> | <b>2</b> | <b>2</b> | <b>.....</b> | <b>866</b> | <b>5,984</b> |

**Total Valid State Certificates Outstanding to Date July 1, 1960-December 31, 1968**

|                   |            |               |              |               |              |            |            |           |           |          |               |               |
|-------------------|------------|---------------|--------------|---------------|--------------|------------|------------|-----------|-----------|----------|---------------|---------------|
| Wood.....         | 593        | 17,108        | 4,550        | 13,095        | 2,716        | 207        | 257        | 4         | 7         | .....    | 8,123         | 30,414        |
| Steel.....        | 66         | 129           | 236          | 300           | 821          | 247        | 125        | 51        | 11        | .....    | 1,259         | 727           |
| Aluminum.....     | 78         | 14,605        | 186          | 2,588         | 231          | 120        | 13         | 3         | .....     | 2        | 508           | 17,318        |
| Plastic.....      | 122        | 12,732        | 1,322        | 10,868        | 193          | 85         | 23         | 6         | 1         | .....    | 1,661         | 23,691        |
| Other.....        | 41         | 4,703         | 150          | 2,715         | 28           | 65         | 6          | 7         | .....     | .....    | 225           | 7,490         |
| <b>TOTAL.....</b> | <b>900</b> | <b>49,277</b> | <b>6,444</b> | <b>29,566</b> | <b>3,989</b> | <b>724</b> | <b>424</b> | <b>71</b> | <b>19</b> | <b>2</b> | <b>11,776</b> | <b>79,640</b> |

**REPORT OF CERTIFICATES OF NUMBER ISSUED TO MOTORBOATS**  
**Certificate of Number Issued During Period January 1, 1969-December 31, 1969**

|                   |            |               |              |              |            |            |           |           |          |              |              |               |
|-------------------|------------|---------------|--------------|--------------|------------|------------|-----------|-----------|----------|--------------|--------------|---------------|
| Wood.....         | 73         | 2,304         | 611          | 1,439        | 279        | 26         | 19        | 3         | .....    | .....        | 982          | 3,772         |
| Steel.....        | 3          | 19            | 19           | 34           | 53         | 48         | 14        | 7         | 1        | .....        | 90           | 108           |
| Aluminum.....     | 21         | 3,543         | 75           | 638          | 32         | 46         | 2         | 2         | .....    | .....        | 130          | 4,229         |
| Plastic.....      | 28         | 4,361         | 386          | 2,980        | 55         | 49         | 9         | 3         | .....    | .....        | 478          | 7,393         |
| Other.....        | 11         | 911           | 31           | 628          | 4          | 24         | 1         | 7         | .....    | .....        | 47           | 1,570         |
| <b>TOTAL.....</b> | <b>136</b> | <b>11,138</b> | <b>1,122</b> | <b>5,719</b> | <b>423</b> | <b>193</b> | <b>45</b> | <b>22</b> | <b>1</b> | <b>.....</b> | <b>1,727</b> | <b>17,072</b> |

**State Certificates of Number Cancelled and Withdrawn During Period**

|                   |           |              |            |              |            |           |           |           |              |              |              |              |
|-------------------|-----------|--------------|------------|--------------|------------|-----------|-----------|-----------|--------------|--------------|--------------|--------------|
| Wood.....         | 50        | 2,974        | 665        | 1,879        | 357        | 18        | 29        | 7         | .....        | .....        | 1,101        | 4,878        |
| Steel.....        | 3         | 8            | 31         | 40           | 114        | 20        | 16        | 4         | .....        | .....        | 164          | 72           |
| Aluminum.....     | 6         | 1,470        | 13         | 244          | 23         | 5         | .....     | .....     | .....        | .....        | 42           | 1,719        |
| Plastic.....      | 10        | 1,302        | 78         | 795          | 15         | 3         | 6         | .....     | .....        | .....        | 109          | 2,100        |
| Other.....        | 5         | 380          | 14         | 217          | 1          | 14        | .....     | .....     | .....        | .....        | 20           | 601          |
| <b>Total.....</b> | <b>74</b> | <b>6,134</b> | <b>801</b> | <b>3,175</b> | <b>510</b> | <b>60</b> | <b>51</b> | <b>11</b> | <b>.....</b> | <b>.....</b> | <b>1,436</b> | <b>9,370</b> |

**Total Valid State Certificates Outstanding to Date July 1, 1960-December 31, 1969**

|                   |            |               |              |               |              |            |            |           |           |          |               |               |
|-------------------|------------|---------------|--------------|---------------|--------------|------------|------------|-----------|-----------|----------|---------------|---------------|
| Wood.....         | 616        | 16,438        | 4,496        | 12,655        | 2,638        | 215        | 247        | .....     | 7         | .....    | 8,004         | 29,308        |
| Steel.....        | 66         | 140           | 224          | 294           | 760          | 275        | 123        | 54        | 12        | .....    | 1,185         | 763           |
| Aluminum.....     | 93         | 16,678        | 248          | 2,982         | 240          | 161        | 15         | 5         | .....     | 2        | 596           | 19,828        |
| Plastic.....      | 140        | 15,791        | 1,630        | 13,053        | 233          | 131        | 26         | 9         | .....     | .....    | 2,029         | 28,984        |
| Other.....        | 47         | 5,234         | 167          | 3,126         | 31           | 85         | 7          | 14        | 1         | .....    | 253           | 8,459         |
| <b>TOTAL.....</b> | <b>962</b> | <b>54,281</b> | <b>6,765</b> | <b>32,110</b> | <b>3,902</b> | <b>867</b> | <b>418</b> | <b>82</b> | <b>20</b> | <b>2</b> | <b>12,067</b> | <b>87,342</b> |

# Water Pollution Control Division



ROBERT A. LaFLEUR  
Chief

**T**HE WATER POLLUTION CONTROL DIVISION has continued, as in the 1966-67 biennium, to carry an extremely heavy work load. It has been successful in replacing one chemist on the laboratory staff; however, during the same period it has lost personnel among its field staff that it has been unable to replace. Currently the staff consists of one division chief (who also serves as executive secretary of the Louisiana Stream Control Commission), one assistant chief, two full-time chemists, one chemist on a part-time loan basis, one engineer, three field biologists, seven waste disposal investigators and one secretary. There is a serious need to add one chemist and three field biologists to our staff.

Division activities are largely designed to serve the needs of the Stream Control Commission, the state's water pollution control authority. The Stream Control Commission is an ex-officio, non-budgeted agency—any expenditures incurred are included in those of the Water Pollution Control Division—represented by the following state agencies: Wild Life and Fisheries Commission, the Attorney General, Department of Agriculture, Department of Health, Department of Commerce and Industry, Department of Conservation, and the Department of Public Works.

During the 1968-69 calendar years the division has engaged in the following activities:

1. Continued a statewide water quality monitoring program initiated in 1958. The network is comprised of 60 sampling points on 30 streams; this includes all of the state's major streams and a number of lesser ones. Thirteen water quality parameters are recorded on a monthly basis. Data gathered provide a continuous record of stream quality that are referred to in determining whether or not a given stream can safely assimilate a proposed industrial waste discharge. These data were also extensively used in establishing water quality standards required by federal law.

2. Maintained close surveillance on raw sugar factories and receiving streams for these waste discharges.

It should be recorded that Bayou Teche has been severely degraded by sugar mill discharges. During both cane grinding seasons, 1968 and 1969, this situation was discussed at Stream Control Commission meetings. The Commission has recommended that rigid enforcement of rules and regulations applicable to sugar factory pollution be implemented during the 1970 cane grinding season.

3. Provided the Stream Control Commission with technical information for 10 meetings. The Commission has reviewed 75 waste discharges.
4. Conducted 15 fish kill investigations. Of this total four were attributed to pesticides.
5. Continued negotiations with the Federal Water Pollution Control Administration to achieve approval of water quality standards adopted in mid-1967.
6. Worked to obtain adoption of a statewide order prohibiting oil field salt water and waste oil discharges to the state's fresh water bodies, in cooperation with the Louisiana Department of Conservation.

Approximately 95 percent of the pro-

duced oil field salt water is now being sub-surfacely injected.

7. Conducted a joint survey with the Louisiana Department of Health's Engineering Division on the Vermilion River to assess the pollution of this stream.

The report of the survey was to serve as the basis for a public hearing January 28, 1970.

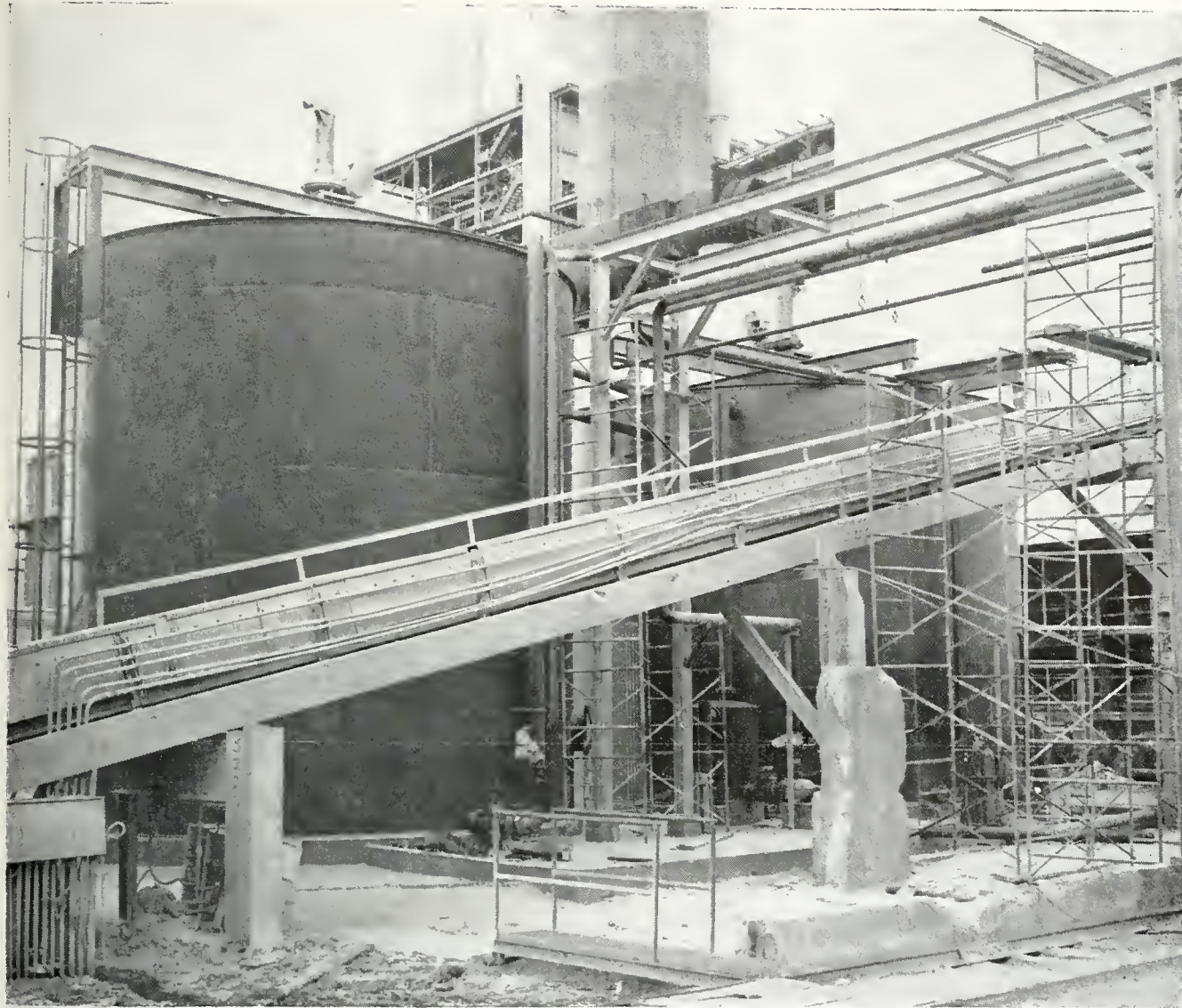
8. Participated in a joint study of the Mississippi River to ascertain the contributing factors of severe off taste of potable water supplies drawn from the river by almost half of Louisiana's population.
9. Intensified oil pollution surveillance in the

coastal areas with the assistance provided by Louisiana Wild Life and Fisheries Commission's Enforcement Division.

10. Initiated a biological and chemical survey of the Calcasieu River in the Lake Charles area to evaluate the degree of pollution in the river. This survey effort is in cooperation with the Federal Water Pollution Control Administration.
11. The division staff has spent many hours reviewing industrial waste discharge permits. This information will be used by the Stream Control Commission to ascertain whether or not additional waste treatment is required.



Oxygen depletions resulting from industrial pollution continue to cause fish mortalities in Louisiana's streams.



Two of the Kraft process paper mills in Louisiana are among the first mills in the United States to install color removal units.

## INDUSTRIAL EXPANSION

In the last four years industrial expansion in Louisiana has exceeded three billion dollars of capital outlay. During 1967 alone industrial expansion reached 750 million dollars. Approximately 70 percent of the industrial discharges were to the Mississippi River, 20 percent were for the industrial complex on the Calcasieu River in the Lake Charles area, and the remaining 10 percent were on other streams. Included in the vast industrial expansion are five new paper mills, two new oil refineries, five new fertilizer plants, and numerous chemical and petrochemical facilities. This industrialization will continue to provide a challenge for technology of control for developing new and needed methodology for waste treatment that is not available. The Mississippi River is particularly challenging because this river serves as the only available potable

water supply for one and a half million people, in addition to being a nutrient source for a multi-million dollar sport and commercial fishing industry in the estuarine areas at its mouth.

## LOUISIANA RIVER BASINS

The Pearl River on Louisiana's eastern border is in good condition for most of its course. The Bogalusa City sewage and paper mill discharges are being treated prior to discharge. Additional treatment now being planned for the paper mill waste will enhance the river's quality.

The Bogue Falaya and Techefuncte rivers have good water quality. However, there have been occasional complaints of turbidity in the Bogue Chitto, Tangipahoa and Amite rivers from gravel mining operations.

The Mississippi River carries the heaviest burden in the entire state. As industrial and domestic waste discharges continue to increase maintain-

ing good water quality in this river is a very complex assignment. Taste and odor problems in potable water supplies are our most immediate concern.

The Atchafalaya River is the largest stream in the state with good water quality. Abatement and/or elimination of oil field waste discharges has improved this quality.

Bayou Teche and the Vermilion River are seasonally in poor condition due to heavy waste loads that the streams are incapable of assimilating during low flow periods.

Increased industrial waste discharges to the Calcasieu River during the past four years have caused water quality degradation. This is a matter of serious concern.

The Sabine River has good water quality, but industrialization of this basin and flow regulation associated with the Toledo Bend Dam can be potential problems in the future.

Because Red River waters are affected by naturally occurring salt flats upstream from Louisiana it has served little purpose except as a drain-

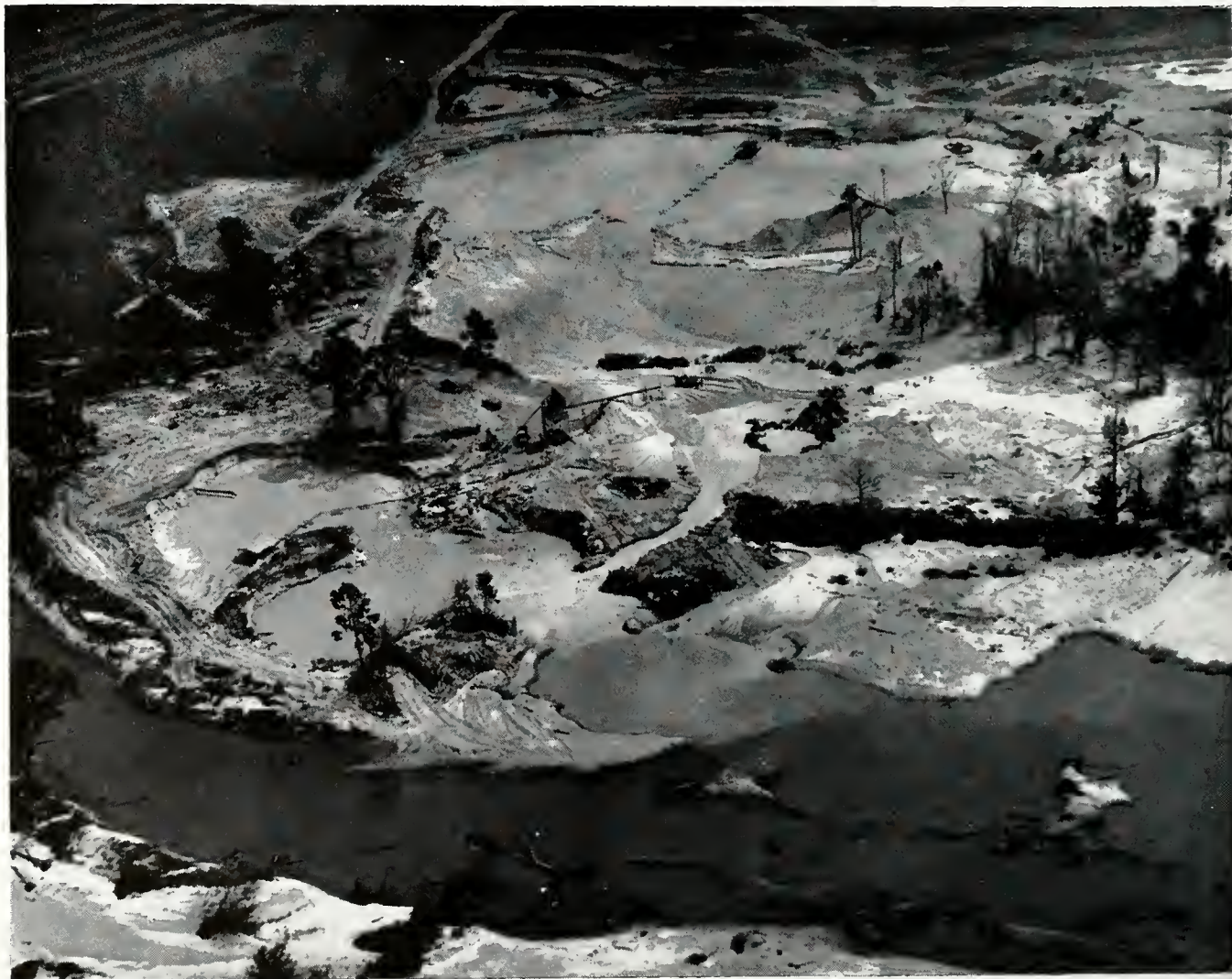
age ditch for many years; however, attempts are now being made to control this phenomena. Some industrialization has begun on this stream, including one paper mill, one detergent plant and three metal plating and chemical plants in the Shreveport area.

The Ouachita River has improved since the installation of treatment facilities for industrial paper mill wastes at West Monroe and domestic waste from West Monroe, although there is intermittent water discoloration caused by paper mill waste in Arkansas. A rather ominous salt content increase has been noted recently; Arkansas pollution control officials have been contacted regarding this condition.

Bayou Beouf, Bayou Macon, the Tensas and Black rivers have good water quality; no degradation is envisioned at this time.

Little River water quality is greatly improved by the reduction of oil field brines previously discharged to this stream; we expect continued improvement.

Dugdemona River has a high color resulting



Gravel mining operations cause pollution in some of Louisiana's streams by discharging water with an extremely high silt content.

from treated paper mill waste discharge and it seems to be a limiting factor in fish production. Through a federal research grant the paper mill is constructing a color removal installation that should be completed in mid-1970.

Additional work either completed or begun during this biennium includes:

1. Completion of a sanitary survey of Boudicks Lake in cooperation with the Louisiana Department of Health.
2. Completion of a survey in cooperation with several industries to determine the range of sulfates in the Mississippi River from St. Francisville to a point below New Orleans.
3. Indoctrination of personnel of Louisiana Wild Life and Fisheries Commission's Enforcement Division in oil field pollution investigation procedures.
4. Initiation of a biological and chemical survey of Bayou Vincent and Bayou Bonfouca in St. Tammany Parish to determine the effects of industrial and municipal discharges to these streams. This study will be completed by November 1970.
5. Initiation of a chemical survey of the Intracoastal Waterway southwest of Lafitte to determine the range of salinities of these waters and the effects of oil field brine discharges to these waters. This work will be completed as time permits.
6. Initiation of a study to determine the effect of frequent oil spills on the vertebrate and invertebrate population of an estuarine environment.

As a result of investigations conducted by members of this division during the past biennium, at least 450 citations were issued either by the Louisiana Wild Life and Fisheries Commission or the Louisiana Department of Conservation. In most cases corrective action was taken by the offender within 10 days.

When the issuance of a citation did not bring about effective pollution abatement, criminal charges were filed; 30 such charges were filed. In nearly half of the cases a plea of guilty was entered or bonds were forfeited, two cases were not processed, and action has not been taken in the remainder of the cases at this time.

The "Plan for Implementation" of Louisiana's water quality criteria includes a concept of water quality control that is not new to Louisiana, however, it has never been practiced here in its entirety. The concept embodies control of pollution at its source instead of after the fact; simply stated, dillution is no longer considered a solution to pollution when the technology and methodology of treatment are known. In this light, members of our technical staff are reviewing permits to discharge to interstate water bodies within Louisiana. To be acceptable: (1) the quality

of a discharge must be compatible with the water quality standards of the receiving stream; and (2) each discharge is required to receive secondary treatment or its equivalent if technology of treatment is known, and the best practicable treatment or control in all other cases. This review will be presented to the Louisiana Stream Control Commission for appropriate action when it is completed.

### Technical Investigators

T. J. Gilbert, Assistant Chief, Baton Rouge; L. R. Kuss, Chief Chemist, Baton Rouge; J. S. Mathis, Chemist, Baton Rouge; Joe E. Belka, Chemist, Baton Rouge; D. B. Reed, Engineer, Statewide; J. D. Givens, Biologist, Baton Rouge; T. L. Bradley, Biologist, New Orleans; and L. R. Still, Biologist, Shreveport.

### Waste Disposal Investigators

R. L. Bourriague, Lafayette; W. C. Dixon, Atchafalaya Spillway; E. W. Goodwin, Minden; A. E. Howard, Bogalusa; P. A. Paul, Jena; L. D. Racca, Lake Charles; and L. L. Reed, Iota.

Greater emphasis, energy and more money have been directed toward producing a better, healthier, more enjoyable life for all of our citizens in the calendar years 1968 and 1969. Despite these efforts, environmental problems such as water and air pollution clearly indicate that we are falling behind in our quest for a better environment.

The past two years have produced several catastrophic events in the field of water pollution. The devastation caused by the sinking of the Torre Canyon and the mishap on Platform "A" off the California coast has produced a well informed, enraged public. The same public, who only a decade ago was apathetic to the water pollution situation, now realizes that water is a requirement so basic to man's existence that all other resources are either dependent on its plentiful supply, or in its absence, valueless for man's use and development.

The Water Pollution Control Division of Louisiana Wild Life and Fisheries Commission, the appointed technical water quality authority of this state, has made significant progress in the field of water pollution abatement. This has been accomplished primarily through the cooperative efforts of the division and many responsible municipal and industrial leaders. In other instances, it was necessary for the division to initiate legal proceedings against those who were not in compliance with existing regulations and laws.

Ironically enough—at the time of greatest national and local concern—the agency responsible for the greatest natural resource in our state, be-



Oil company personnel use hay to remove oil from a small stream in South Louisiana.

cause of inadequate pay rates, has progressively decreased in size, thereby decreasing its efficiency and scope of operation. With the greatest challenges in the field of water pollution abatement yet to come, it is questionable that this organization presently staffed by about one dozen people can handle the onslaught of technical problems that will arise as a result of our water quality criteria and plan for implementation.

The nucleus of this division has been built around two large, well equipped biological and chemical laboratories located on the campus of Louisiana State University, Baton Rouge. Our presence on the campus affords not only an academic surrounding with complete library facilities, but also an available staff of experts in fields ranging from bacteriology to zoology. Additionally, it enables this organization to more closely monitor the activities of one of our largest industrial complexes. The principal function of this laboratory is to conduct various chemical and biological analyses on samples submitted by investigating teams from this office, waste disposal

investigators, individual citizens, and many industries.

The data obtained from the laboratory tests are interpreted and evaluated by members of the staff which includes: biologists, bacteriologists, chemists, biochemists, and engineers. The conclusions and recommendations of these individuals are then forwarded to the members of the Stream Control Commission and to the individual or industry concerned.

The major questions confronting this organization are:

1. (a) What effect will the discharge of a given volume of a specific waste product have upon the physical, chemical and biochemical properties of a stream?
- (b) Will the quality of the water in this stream adhere to the Water Quality Standards as set forth under the Clean Water Act of 1965 (Public Law 89-234).
2. What type of corrective treatment is necessary before said waste can be discharged into a stream?



Large surface aerators are used in some waste treatment operations to reduce pollution load to streams.

3. How long will it take a given stream to recover from the discharge of this waste?

Some of the various types of waste materials which are submitted for analyses are as follows:

1. Oil residues and phenolic wastes from petroleum and chemical industries
2. Any substance thought to contain pesticide residues
3. Gravel pit washings
4. Process and wash water from sugar mills, pulp and paper mills, and food processing plants
5. Oil drilling muds and salt water brine from petroleum production fields
6. Sewerage plants, oxidation ponds, and septic tank influents and effluents
7. Wash waters, spoiled fluids, and paunch contents from slaughter and packing houses

It can be readily seen from the above that an enormous variety of substances are being introduced into our waters, both organic and inorganic.

The most desirable method of treating wastes is to recover these wastes for use or reuse. How-

ever, in the majority of cases this is not economically feasible. Therefore, the primary requisite in solving a pollution problem or in selecting a method of treatment prior to discharge is knowledge of the physical state and chemical composition of the waste in question.

The fundamental parameter used in determining the relative condition of a stream, its ability to maintain a suitable aquatic fauna, is its dissolved oxygen content. The dissolved oxygen (DO) content is generally determined using the sodium azide modification of the Winkler Method.

The most important single determination used for the analyses of decomposable organic matter by means of aerobic biochemical action is referred to as the Biochemical Oxygen Demand (BOD). This BOD analysis furnishes the investigator with a means of determining the amount of oxygen required by microorganisms (bacteria) to decompose (stabilize) a given amount of waste matter. The numerical value of this test is usually expressed in parts of oxygen per million parts of waste material.

The data obtained from BOD and DO analysis

make it possible to calculate, with a fair degree of accuracy, the ability of a stream to assimilate wastes of different composition. There are, of course, many other factors that must be taken into consideration such as: (1) thoroughness with which the waste is mixed with water; (2) changes in the solubility of oxygen in water with changes in temperature, the former increasing as the latter decreases; (3) lowered microbial activity with a decrease in temperature; (4) rate of flow of the receiving stream; (5) changes in the solubility of oxygen in the water with an increase in soluble salts; (6) variations in the concentration of waste matter.

Table No. I gives an indication of the number of BOD analysis completed during the past bien-nium.

**Table No. I**  
**B.O.D. ANALYSES 1968-1969**

| <i>Source of<br/>Sample</i>            | <i>Number of<br/>Samples<br/>Analyzed</i> | <i>Per Cent<br/>of Total</i> |
|----------------------------------------|-------------------------------------------|------------------------------|
| Sugar Mills .....                      | 361                                       | 17.4                         |
| Municipal Sewage .....                 | 109                                       | 5.0                          |
| Mississippi River .....                | 200                                       | 9.6                          |
| Food Processing Plants .....           | 311                                       | 15.0                         |
| Slaughterhouses .....                  | 66                                        | 3.2                          |
| Pine Products Plants .....             | 44                                        | 2.1                          |
| Cotton Seed Oil Mills .....            | 18                                        | .9                           |
| Petroleum and<br>Chemical Plants ..... | 79                                        | 3.8                          |
| Paper Mills .....                      | 180                                       | 8.7                          |
| Miscellaneous Water .....              | 716                                       | 34.3                         |
| <b>TOTAL .....</b>                     | <b>2,079</b>                              | <b>100.0</b>                 |

Industries concerned with inorganic waste products have a problem of a somewhat different nature. Normally, inorganic wastes are not subjected to any biological treatment because of their relatively inert nature as a substrate for microbial development. In addition, the discharge of these wastes, because of their high alkalinity, acidity, or toxicity or microorganisms, may so upset the natural balance of life in waters that natural biological purification cannot progress normally. Therefore, these wastes are usually controlled by physical or chemical separation.

As a result of the many technologic advances which have come forth during the last few years, we have been forced not only to change our way of living, but thinking as well. Modern instrumentation has provided us with the necessary means of detecting concentrations of materials never before thought possible, consequently, substances once thought to be free of contamination can now be shown to contain harmful materials.

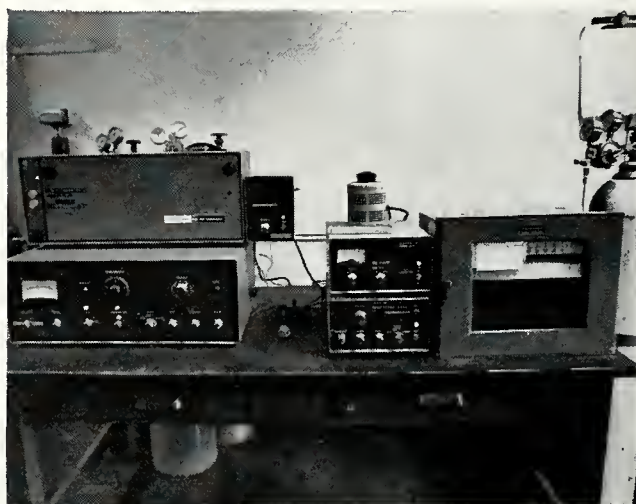
This is vividly exemplified by the current emphasis on pesticides and pesticide residue analysis.

Pesticides, by virtue of application methods, both direct and indirect, come into contact with just about all things injected by man and animals. The isolation and identification of a particular pesticide presents many problems to the workers in this field. Generally, the major problems encountered are as follows: (a) Selection of a suitable solvent, one in which only the pesticide is soluble and it itself being easily reduced in volume without subsequent loss of the pesticide. (b) Removal of any interfering substances.

## GAS CHROMATOGRAPH

Gas Chromatography is a physical method of separation in which the components to be separated are distributed between two phases, liquid and gas. Separation depends on the relative affinity of the immobile phase of various pesticides. Simply stated, a gas chromatograph functions as follows: (1) A carrier gas (mobile phase) is introduced under pressure so that it will flow through a packed column. This carrier gas is an inert gas and its rate of flow through the column is controlled by various devices such as pressure regulators and rotameters. (2) The columns are nothing more than small diameter tubes which have been packed with a sorbent. This sorbent material is composed of an inert material such as diatomaceous earth (Solid Support) which has been previously coated with a non-volatile substance such as Dow-Corning high vacuum grease (Liquid Phase).

When a sample containing a mixture of components is injected into the moving gas stream, the various components pass through the column at different rates depending on their respective volatilities and interactions (adsorption) with the



**Perkin Elme Gas Chromatograph.**

substances contained in the column. Therefore, the various components leave the column at different time intervals. As each component leaves the column it is carried to a highly sensitive electron capture detector. The detector produces an electronic signal which is recorded on a chart.

Identification and quantitation of a component is accomplished by comparing the retention time and peak height of the substance in question with the retention time and peak height of a pure compound.

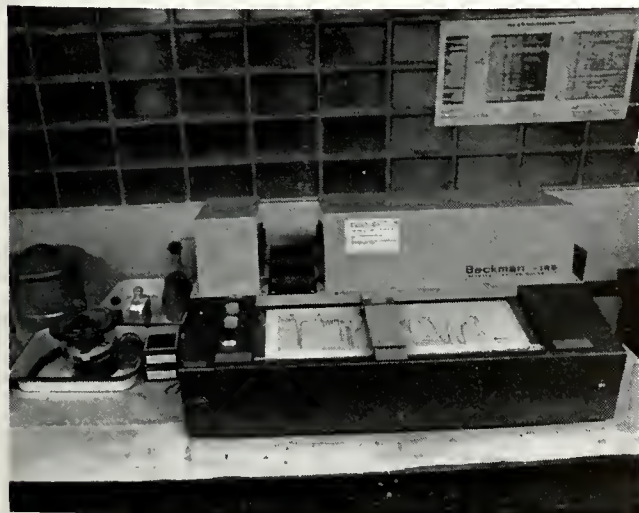
Frequently, the results obtained from a particular column are confirmed by reinjection (sample size permitting) into a column containing a different substrate, thereby, obtaining different retention times.

Thin layer chromatography, routinely used, not only provides us with another confirmatory method but also provides an excellent cleanup and separation procedure. This method makes it possible for us to measure and identify relatively pure compounds with a minimum of interference. Of particular importance is the frequent separation of components having approximately equal retention times.

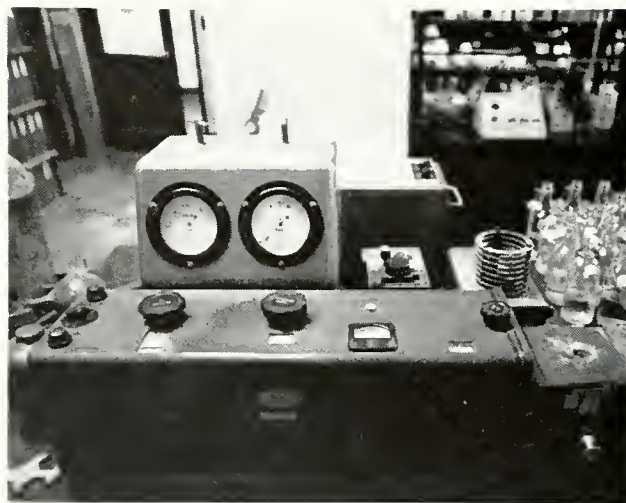
The introduction of thin layer and gas chromatography into this laboratory has made it possible for us to separate, identify, and quantitate nanogram ( $10^{-9}$ g) concentrations.

### INFRARED SPECTROPHOTOMETER

The IR-5 Infrared Spectrophotometer has played a major role in our analyses, particularly so in the identification of oils and oil based muds. The majority of complaints originate with oyster farmers in the coastal areas; others come from individuals who live in oil producing areas. Today's analytical procedures make it relatively easy to extract, cleanup, and identify oil residues from both mud and water samples.



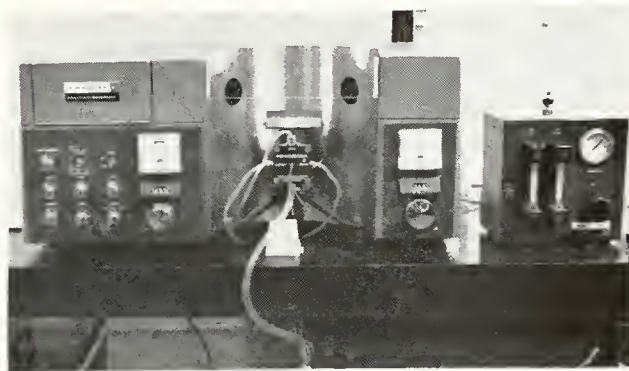
Beckman Du Spectrophotometer.



Beckman IR-5 Infra Red Spectrophotometer.

### ATOMIC ABSORPTION SPECTROPHOTOMETER

The most recent major piece of laboratory equipment purchased by this organization is the Model 303 Atomic Absorption Spectrophotometer. Atomic absorption is a method which determines the concentration of metallic and semi-metallic elements in solution, or in very fine suspension. The method is based on the fact that each element, when in its atomic state, can absorb light at specific wave lengths. Sample elements are reduced to their atomic state by burning them in a flame. Light from the hollow cathode lamp, which emits the spectrum of the element of interest, is passed through the flame, and the degree of absorption is measured. Using this instrument at least 65 elements can be determined at the ppm level, or below. Larger concentrations of the elements are also readily measured.



Perkin Elmer Atomic Adsorption Spectrophotometer.

## BIOASSAY

Another form of analysis frequently used by this organization is the bioassay. This technic provides valuable information on the properties of a particular waste product. The methods that we use are based on two concepts: (1) The substance itself may actually be toxic to fish. (2) The second concept is somewhat indirect in that although the substance may not in itself be toxic to fish it may prove to be detrimental if it is capable of interrupting the necessary food cycle.

The procedure for conducting a bioassay is as follows: (1) The test animals are acclimated to laboratory conditions. (Blue Gills are used in testing for direct toxicity and *Daphnia magna*

for indirect toxicity.) (a) Testing vessels are set up containing a good grade of distilled water to which various mineral salts have been added. (b) Various concentrations of the substance to be tested are added to the vessels over a wide range. (2) Observations are made over 24, 48 and 96 hour periods.

The results of the bioassay are usually reported as a 24 or 48 hour TLm, that is the concentration of the substance which will kill 50 per cent of the test organisms in a given period of time. These results are of great value in determining the maximum concentration that a healthy fish community in a stream may be expected to tolerate.

# Fish And Game Division



JOE L. HERRING  
Chief

**T**HE FISH AND GAME DIVISION is one of the more complex divisions of the Louisiana Wild Life and Fisheries Commission. State-wide duties of this division involve research and development work on all game and fish species, including both fresh and salt water fish. Providing adequate hunting and fresh water fishing is the primary function and goal of this division. However, the division is actively engaged in various other forms of outdoor recreation such as camping, picnicking, boating, providing areas for hikers, bird watchers and others.

Due to large areas of land being cleared, especially of the bottomland hardwood type, wild-life problems are becoming more acute. With the decrease of available areas in which to hunt and fish, and an increasing number of hunters and fishermen, lands and waters must be managed for the maximum yields.

The Commission has an active land acquisition program underway. Commission ownership of land assures maximum public utilization by outdoor enthusiasts. The Commission needs additional funds for land acquisition and adequate funds for management of the areas it has.

In the past two years the Commission has completed construction of new district offices in Monroe, Lake Charles and Baton Rouge. The Opelousas district office was doubled in size during this period and the DeRidder district office moved to Lake Charles.

During this period the turkey trapping and transplanting program was accelerated. Areas that have been stocked are now supplying turkeys to stock other areas of the state. Hopefully, the same thing can be done with turkeys as was done with deer. With the present program it may be possible to have the state stocked in the next 10 years.

The Fish and Game Division with its seven major sections has accomplished much during the past two years. It has represented the sportsmen of Louisiana at many regional and national conferences concerned with hunting seasons for doves, waterfowl, woodcock, snipe, rail and gallinules.

Due to increased pressure on hunting and fishing areas additional financial support will be needed in years to come. More leisure time finds the public turning to the out-of-doors for recreation.

During the next two years the Fish and Game Division will need additional technical and supporting personnel as well as equipment and materials to take care of the public needs. The fisheries section and water hyacinth control section are in immediate need of personnel. Without additional personnel for hyacinth control work many streams and lakes will be covered with this noxious weed. Such areas will not be accessible for fishing, hunting, boating, trapping, transportation or other water-related activities.

In reviewing the contents of this report covering the past two years, it is apparent that progress has been made in fish and game management, facilities for outdoor recreation, predator control work and the many other phases of the Fish and Game Division.

## BUREAU OF OUTDOOR RECREATION

DEWEY W. WILLS  
Coordinator

During the past biennium, due to a necessary austerity program, only a minimum number of projects eligible for cost-sharing under the Land and Water Conservation Fund Act were initiated. However, eight boat ramps were constructed, the first phase of the Saline Camping Area was completed and 450 acres of land were acquired under the U. S. Bureau of Outdoor Recreation program. This represents a total expenditure of \$95,580.88 of which one-half of the funds were furnished by the Land and Water Conservation Fund.

Other activities of the Bureau of Outdoor Recreation Section included: assistance in preparing the Outdoor Recreational Potential Surveys of

several parishes; preparing and submitting report on game and fish harvest for National Agricultural Chemical Association; Strenuous Outdoor Recreation Activities for Stanford Research Institute; Recreational Activities on Private Land for Southwest Research Institute, and several questionnaires on outdoor recreation.

During the period covered by this report the Bureau of Outdoor Recreation Coordinator attended the Southeastern Association of Fish and Game Commissioners, Governor's conference on Hardwoods (Arkansas) and numerous other seminars and meetings pertaining to outdoor recreation.

The Coordinator also represented the Commission and served on the Recreational Subcommittee of the State Technical Action Panel, the Task Force Committee on Parks, Recreation and Tourism of the Goals for Louisiana Committee and the Recreational Advisory Council.

Through the joint efforts of several agencies, both private and public, it was possible to get a change order from the Louisiana Department of Highways and the Bureau of Roads altering the Interstate Highway 10 bridge crossing at Blind River. Original plans called for an eight foot clearance between high water and the overpass on Blind River. This would have resulted in restricting passage on Blind River to only small boats. Consequently the vast recreation potential of this area could never be realized due to the inaccessibility created by the low clearance of the bridge. After several meetings the Louisiana Department of Highways and the U. S. Bureau of Roads agreed to issue a change order whereby there would be a 25 foot clearance on Blind River rather than an eight foot clearance as originally planned. This office had a minor part effecting this change order.

Following is a list of all BOR projects that the Louisiana Wild Life and Fisheries Commission has received matching monies from the Land and Water Conservation Fund:

| <i>Project</i>                              | <i>Acquisition</i> | <i>Development</i> |
|---------------------------------------------|--------------------|--------------------|
| Bogalusa Boat Ramp .....                    | 770.00             | .....              |
| Spring Bayou Wildlife Management Area ..... | 411,751.00         | .....              |
| Red River Wildlife Management Area .....    | 400,400.00         | .....              |
| Spring Bayou Tract .....                    | 1,475.00           | .....              |
| Long Lake Boat Ramp .....                   |                    | 5,205.72           |
| Saline Camping Area .....                   |                    | 11,310.00          |
| Lake Bistineau Ramp .....                   |                    | 6,331.00           |
| Sabine Boat Ramp .....                      |                    | 8,990.00           |
| Berwick Boat Ramp .....                     |                    | 9,572.16           |
| Spring Bayou Boat Ramp ..                   |                    | 10,100.00          |
| Delcambre Boat Ramp .....                   |                    | 7,749.00           |
| New Iberia Boat Ramp ....                   |                    | 9,931.00           |
| Dorcheat Boat Ramp .....                    |                    | 7,942.00           |
| Black River Acquisition ....                | 2,275.00           | .....              |
| Spring Bayou Acquisition ..                 | 14,700.00          | .....              |
| Caddo Lake Boat Ramp .....                  |                    | 7,834.64           |
| Total .....                                 | 831,371.00         | 84,965.52          |
| Grand Total                                 | \$916,336.52       |                    |

The Louisiana Wild Life and Fisheries Commission Outdoor Recreation program will continue to move forward, as funds permit, in acquiring lands for wildlife management purposes and develop needed recreation facilities to meet increasing demands of outdoor enthusiasts.

## Engineering and Construction

**W. E. ACKLEN**  
Engineer

The Engineering and Construction Section of the Fish and Game Division is composed of one professional engineer, three carpenters, one painter, one plumber, one electrician and one secretary. It is the responsibilities of this section to keep in a good state of repair all buildings, grounds, fences, boat launching ramps and other properties belonging to the Louisiana Wild Life and Fisheries Commission. In the period covered by this report the section has received and completed more than two hundred requests for maintenance, repairs and new construction. Examples of this type of work consists of jobs like cleaning and painting of office buildings, taking out partitions and installing new ones to re-arrange office space to make it more efficient, construct new warehouses, equipment sheds, boat storage buildings, permit stations, radio transmitter houses, add additions to existing structures, new natural gas distribution systems, new water systems, repairs to central air condition and heating systems, construction of boat docks, water storage tanks, water control structures, roads, bridges, fences, airplane landing strips and many other similar projects. This section also assists supervisors and study leaders in gathering various data in their projects of game management.

## Aquatic Vegetation Control Section

**DON LEE**  
Acting-Coordinator  
**LOUIE RICHARDSON**  
Field Supervisor

It is readily obvious that the water areas of Louisiana are a highly valuable natural resource and greatly contribute to the State's economy. It is unfortunate that the multi-million dollar per year value of these areas can be endangered within a period of less than five years by the unchecked proliferation of aquatic weeds.

The water hyacinth was introduced into Louisiana about 85 years ago. Few, if any, plants have caused greater financial losses or have the capacity to spread so rapidly in such a short period of time.

The water hyacinth control program is extremely important if we are to maintain unimpeded navigation, drainage (agriculture and flood control), sport and commercial fishing, hunting, trapping, recreational boating, other water sports and oil and gas exploration and production. In some areas, the presence of this plant also imposes public health problems.

During 1968-1969, many areas of our State were acutely affected by heavy and extensive infestations of water hyacinths. The reasons for the greatly increased infestations are due not only to budgetary restrictions placed on State and Federal control programs, but also due to the mild winters which Louisiana has experienced the past three years, the natural fluctuations of water levels and other environmental factors. All of these have been conducive to rapid propagation of water hyacinths.

Funds available to the State from the Federal-State Expanded Aquatic Weed Control Program were reduced from \$139,000.00 in 1967 to \$98,000.00 in 1968 to \$83,000.00 in 1969. It is anticipated that only \$30,000.00 will be available to the State from this program in 1970.

In 1965, the Section had a compliment of 29 spray crews (58 men). At the end of 1969, the Section had 17 complete crews and 7 one-half crews (41 men).

The Hyacinth Control Section applied chemical to approximately 21,155 acres of water hyacinths and other aquatic weeds during the 67-68 fiscal year. In 68-69 the approximate acreage treated was 22,601.

For the first time since 1947 aerial applications were used in the aquatic weed control program. A conventional spray application was made in the marsh country below Morgan City by a fixed wing aircraft at a cost of \$4.36 per acre. An invert emulsion mixture was applied on Bundick Lake by a helicopter at a cost of \$8.66 per acre. An application of the invert emulsion type is necessary to avoid damages arising from drifting spray material. Excellent results were obtained from both applications and plans were made to utilize this control technique during fiscal year 1970, however, funds for such an operation will not be available.

Submersed vegetation is another problem the Section is concerned with. At the present time, our research biologist position is vacant. There is an urgent need to fill this position as an increase in research effort is needed to devise methods of control which will enable the aquatic vegetation control program to stop the rapid encroachment of these plants; to fulfill its mission of returning the weed clogged waters of the state

to the fishermen, hunters, and boatmen, and to maintain these waters in condition to insure their total utilization.

## Fisheries Section

HARRY E. SCHAFER  
Supervisor

The Fisheries Section is responsible for research, development and management of all game fish and fresh water commercial fish. This does not only include finfish but all aquatic animals that have commercial, sporting or recreational value. This includes frogs and crawfish.

Three sources of funds were used by the Fisheries Section—two from federal sources and one from state. The three sources were: first, money received under the Dingell-Johnson program. This money which is derived from a federal excise tax on fishing tackle is allocated to the states based on land area and on the number of fishing licenses sold in the state. Second, money was received under the Anadromous Fish Act. This was a five year program where money was allocated to coastal state and Great Lakes states to study the anadromous fish species. These funds are scheduled to terminate June 1970. Third, money was allocated to the section from the Louisiana Wild Life and Fisheries Commission's annual budget. The monies from this source are used for research, management, development, maintenance and operational costs.

Two new Dingell-Johnson projects were initiated during this period. The first one is entitled "An Inventory of the Morphometry and Facilities of Louisiana's Large Inland Lakes". Its objective is to prepare a fishermen's guide to inland lakes in Louisiana. The first phase is lakes over 1,000 acres. The second new project entitled "Survey of Estuarine Sport Fish" was started to give the sportfishermen an index by which fishes can be caught at a particular location at different times of the year and the catchability of these fishes.

The section hired one new fishery biologist, Ted Enloe, but he was killed in an automobile accident while returning home from a meeting. He had worked for approximately nine months. He has not been replaced.

The cooperative fish disease and parasite project continues, but it is now financed through our Dingell-Johnson program instead of a state project. The personnel from Auburn University on this project gave the state fisheries personnel, state university personnel and private fish farmers a two day workshop at the Monroe Fish Hatchery.

Projected needs of the section are as follows:  
Renovations of LaCombe Fish Hatchery and

the purchase of adjacent property for expansion. Ponds are needed for the striped bass program.

Beechwood Fish Hatchery should have at least 30 more acres of water and new holding facilities, in order to meet the needs of the lakes.

Creel census on lakes and streams and an economic evaluation of the sport fisheries. This is needed because of the changes being made by channelization, draining, clearing and other practices detrimental to fisheries. In trying to defend the fisheries, the section cannot put a monetary value or a use value.

Much more work is needed on crawfish and catfish, and efforts will be put forth to gather more information.

Fish farming is becoming a big industry in the state and much work is needed so that these people can be guided and more efficient methods of fish farming developed.

To accomplish the above more technical and non-technical personnel will be needed plus the equipment to put these people into the field.

## LAKE MAPPING

JIM DAVIS

Fishery Biologist

In Louisiana, very few accurate maps are available to fishermen, hunters, campers or boaters. At the request of many interested parties, the fisheries section has undertaken a project to satisfy this need.

Our first efforts have been concentrated on the inland lakes that exceed 1000 acres in size. To complete the maps depth soundings were taken using a recording fathometer. From these records contours are placed on an outline map. Using these a sportsman can determine deep water areas, steep banks, old channels, etc.

All facilities are also indicated on the maps. These include boat docks, camping areas, launching facilities, etc. Primarily the maps are intended for the use of outdoor enthusiasts. At this time it is anticipated that these maps will be available by late 1970. In subsequent years maps of other areas will be completed. Streams, small lakes and estuarine areas are all in the planning stages. Money to finance a portion of these efforts comes from Dingell-Johnson funds which are dependent on the sale of fishing licenses.

## LAKE AND RESERVOIR MANAGEMENT

CHARLES E. HOENKE

Fisheries Biologist

Lake management requests in Louisiana continue to grow by leaps and bounds. Each year presents many new areas with management needs. Old lakes that are no longer productive need applied management practices to restore them. New lakes need progressive managing from

the initial planning stages to prevent them from becoming unproductive.

The remainder of this report is brief summaries of the type management, results of management, and future recommendations for several lakes studied by Louisiana biologists during 1968-69.

*Lake Bistineau*—A water level fluctuation was initiated in 1966. Rotenone samples in 1968-69 indicated an increase in catchable size game fish and accelerated spawning activities. Obnoxious aquatic vegetation control has been good. A continuation of the present management program is recommended.

*Corney Lake*—Population samples indicate an over population of Gizzard shad. Any recommendations will be delayed pending the repair of both spillway and dam.

*Upper Caney Lake*—Population samples in 1969 indicate a low rate of fish production. This is attributed to a poor basic fertility of the water. A fertilization program will be recommended for this lake.

*Harmon Lake*—Population samples in 1969 indicate a perfectly balanced population. No recommendations made.

*Iatt Lake and Cotile Lake*—These lakes are presently under a three year water level fluctuation program designed primarily for obnoxious aquatic vegetation control.

*Bussey Lake*—Population samples in 1969 indicated a drawdown was needed. The lake was lowered five feet by December 1969. Further recommendations will be made after additional population samples are made.

*Horseshoe Lake*—Increasing numbers of shad and small bluegill in the 1968 and 1969 rotenone samples were responsible for a partial kill recommendation. The partial kill was performed in 1969. Further recommendations will be made following the results of this kill.

*Crew Lake*—A current was created in Crew Lake in an effort to combat obnoxious aquatic weeds. This management technique was successful and recommendations will be made to continue this program.

*Cheniere Lake*—A water level fluctuation program initiated in 1966 has gradually increased the sport fish population. High water in 1968 prevented a drawdown. In 1969 the majority of the Cheniere Lake Commission and Ouachita Parish Police Jury voted not to continue the recommended management program. The millage tax that supported this lake was defeated in 1969. Since the Louisiana Wild Life and Fisheries Commission can only give technical advice on the lake the future of Cheniere Lake is uncertain.

*D'Arbonne Lake*—A water level fluctuation program was initiated on this lake in 1963. Due to unpreventable circumstances this program has varied from year to year. An evaluation of drawdowns on fish populations and weed control has



Biologists begin taking fish population samples by spraying rotenone and dispersing it on False River.

been initiated. Walleye and Striped bass were introduced into D'Arbonne in 1965. The potential of these species is under careful study.

*Lake Bruin*—Population samples indicate the necessity of a rough fish removal program. This management practice is being performed by commercial fishermen under the supervision of the Louisiana Wild Life and Fisheries Commission.

*Anacoco Lake—Bundick Lake—Chicot Lake*—Water level fluctuation programs have greatly reduced aquatic vegetation problems and at the same time have increased fish production. A continuation of these programs is recommended.

In addition to these lakes numerous other lakes were sampled with rotenone, electro-fishing gear, and various nets, to verify such things as spawning activities, presence or absence of certain species of fish and fish populations in polluted areas. Recommendations were made in each area sampled.

Lake and reservoir management offers a tremendous challenge to the fisheries professionals of Louisiana. Without management of lakes, reservoirs, and all other waters of the state, we cannot expect to meet the demands of the increasing angling public. With proper management a

high quality fishery can be offered the public, and Louisiana's fishery personnel can do their part in making Louisiana truly "A Sportsmen's Paradise."



Part of a rotenone sample from False River ready for the sorting table.

## BIOASSAY

**JANICE S. HUGHES**  
Fishery Biologist

It was discovered back in the early 1950's that aquatic weeds could be killed with chemicals. There was one problem. Sometimes fish were killed, too. It had to be determined which chemicals were "safe" for fish and still killed weeds.

Toxicity studies of herbicides (weed killers) using bluegill as test animals began in a small vacant room at the Monroe office in 1957. The equipment was crude and inadequate; heating was poor and cooling was impossible. In spite of these difficulties, data on nine herbicides was completed after one year. This information was well received and demands were made for more data. The Louisiana Wild Life and Fisheries Commission realized the need for this information and in August 1961, one of the finest bioassay laboratories in the United States was constructed.

The laboratory could be held at a constant temperature; the water supply and drainage were convenient; large tanks could hold two-week supplies of fish; test containers were improved; and there was space for 120 of these containers. Dur-



Bioassays were conducted in fish holding tanks during the construction of the Monroe laboratory.



Ten striped bass larvae are transferred in a glass tube to each bioassay container.

ing a five year period, over 130 herbicides were tested on bluegill. Many scientific articles were published and the data is still being used by other research workers, chemical companies and chemical regulatory agencies.

A need for the same kind of information on crawfish was realized and this work was initiated in 1965. Crawfish from a commercial crawfish farm are used as test animals. The size crawfish needed for bioassays are available only during the winter months. Therefore, only 12 chemicals were tested during the initial two year period.

In February 1967 the laboratory and all equipment were destroyed by fire. A new laboratory was planned, but required 18 months before completion. During the construction of the laboratory, no bluegill bioassays were conducted. Three chemicals were tested on crawfish using a small trailer as a temporary laboratory.

Plans were being formulated for bioassays on striped bass long before the laboratory was destroyed. Louisiana started the introduction of striped bass in 1965. Before the Commission could adequately stock these fish, it needed to determine their requirements for survival. Even though it did not have a laboratory, toxicity studies of different water qualities and chemicals to striped bass were initiated in April 1967 in a fish holding shed. Again facilities were poor, but useful information was obtained. Twenty-five chemicals were tested and the results were published.

In September 1968 the section moved into its new modern laboratory. Instead of one room for bioassays, there were two. The temperature can



The toxicity of different chemicals to striped bass larvae is being determined in these bioassay containers.

be held constant in both rooms and in one room can be lowered to 50 degrees Fahrenheit. Well water, bayou water and distilled water which furnish a variety of test conditions are pumped to both rooms. Floor drains are conveniently located so tanks and aquaria can be emptied easily. A preparation laboratory for measuring and weighing chemicals is adjacent to the bioassay laboratories. A modern chemistry laboratory was constructed for water quality analyses. The newest equipment is now available.

During the past year, 34 chemicals have been tested on bluegill, 4 on crawfish and 32 on striped bass. More work needs to be done. Due to a shortage of personnel, the backlog of work requested is constantly increasing. It is hoped that new personnel and facilities in the near future will meet this demand.

## CHANNEL CATFISH CULTURE

**BOBBY T. WALKER**  
Fishery Biologist

Channel catfish is the number one cultured food fish in the United States.

Louisiana is fourth in the nation in pond catfish production—having some 3,200 acres involved at present.

Catfish farming has increased in this state from 1,400 acres in 1967 to 3,200 acres in 1969.

The present acreage figure is expected to triple by 1972. This estimate is based on expanding interest plus the increased culture in neighboring states. Further interest in this expanding industry is evident in the establishing of several chain catfish restaurants and processing plants.

The Fisheries Section has been highly active in supplying literature containing lists of supplies, suppliers, processors, haulers, buyers and sources of other literature, as well as technical assistance



Modern harvest techniques in catfish farming.



Weighing and measuring channel catfish help commission personnel in field consultation and extension services for the catfish farmers.

by consultation and field extension. Technical literature has also been made available.

Field extension-type services have included, technical advice on all types of construction, feeding programs, disease and parasite treatment, oxygen replenishment, water quality determinations, obnoxious vegetation control, dietary problems, spawning and hatching operation, fingerling production, pesticide investigations, selective breeding, eradication of trash species, harvest techniques, marketing, hauling and economics of the above.

Field diagnosis of disease and parasites has been hampered by lack of any field microscope equipment.

During the past two years, fishery biologists have participated in fourteen different catfish farming clinics, speaking on technical subjects and catfish farming in general.

The following chart is indicative of activities and time involved in catfish culture by fisheries personnel.

|                                | 1968 | 1969 |
|--------------------------------|------|------|
| Field Visits .....             | 149  | 165  |
| Office Conference & Laboratory |      |      |
| Diagnostic Services .....      | 253  | 356  |

The above totals 923 attempts to be of service to catfish culturists, in addition to the speaking engagements mentioned above.

The major area of interest and activity is within North Louisiana. Of the above total, districts I, II, III and IV accounted for 79.2 percent. Catfish culture is evident, however, to some degree in every district of the state.

## STATE FISH HATCHERIES

**SAMMY STOKES**  
Fishery Biologist

The fish hatchery program was carried out basically in the same manner as previous years. Our three state fish hatcheries are Beechwood Fish Hatchery, Forest Hill, Louisiana; James A. Noe Fish Hatchery, Monroe, Louisiana, and Huey P. Long Fish Hatchery, Lacombe, Louisiana.

Species of fish produced at Commission hatcheries were bluegill (*Lepomis macrochirus*), large-mouth bass (*Micropterus salmoides*), black crappie, (*Pomoxis nigromaculatus*) walleye (*Stizostedion vitreum vitreum*), striped bass (*Roccus saxatilis*), and (*Tilapia mossambica*). Since the walleye, striped bass and tilapia are covered under another phase in the fisheries reports this part will deal primarily with the three species mentioned above, namely bluegill, large-mouth bass and black crappie. Black crappie and channel catfish were deleted from production during 1968 since the addition of walleye and striped bass rearing projects demanded additional space to carry out a feasible rearing program. It is not known at this time when production of the spe-



Crappie (sac-a-lait) fingerlings to be released in a new public impoundment.



Hatchery production of fish for stocking purposes should be expanded to meet increasing requests for fish.

cies will be resumed since enlargement of hatchery facilities is at a standstill. The production of these species at hatcheries by numbers were two million four hundred one thousand (2,401,000) bluegill, seven hundred forty-two thousand five hundred ninety (742,590) largemouth bass and forty-two thousand eight hundred (42,800) black crappie.

They were stocked in two hundred nineteen (219) private and public impoundments throughout the State.



Bluegill is one of several species raised in Commission hatcheries.

Among the public impoundments stocked were Bayou Rapides Cut-off, Bayou Rouge Cut-off, Bayou St. John, Bodcau Game Management Area ponds, Chicot State Park Lake, Clear Lake, (DeSoto Parish), Evangeline State Park Lake, Flag Lake, Golden Meadow-City Park Lake, Negro Lake, and Sam Houston State Park Lake.

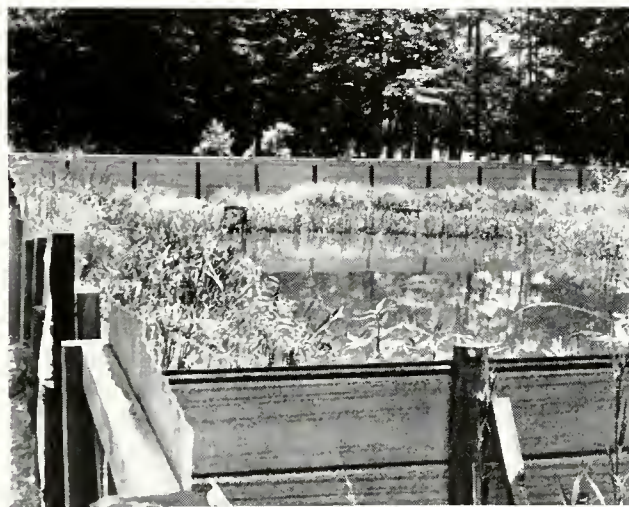
Other impoundments stocked were for the most part privately owned farm ponds.

## BULLFROGS

### SAMMY STOKES

Fishery Biologist

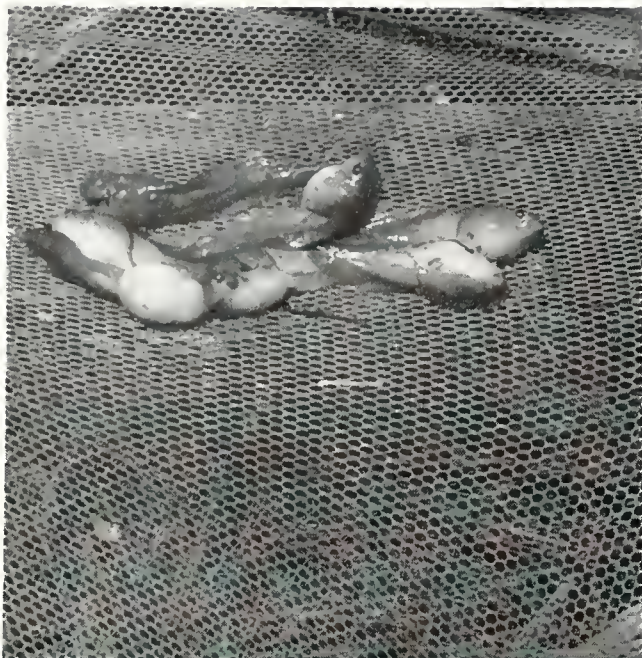
This project was initiated to determine the feasibility of rearing bullfrogs (*Rana catesbeiana*), to commercial market size under domestic conditions.



Pens such as this one at Beechwood are used to study the feasibility of rearing bullfrogs to market size under domestic conditions.

Main efforts in this project during the biennium were directed at types feeds, feeding methods, and stocking rates. During 1968 all methods of feeding and types of feed failed. The survival rate was less than one percent. During 1969 efforts looked some brighter but a lack of individual frogs to work with greatly reduced feeding and rearing efforts to carry out a full scale project. The biologists only had 510 tadpoles but did successfully rear 50 percent of them through November 1969. That is to say approximately half of the tadpoles stocked transformed successfully into frogs during the summer of 1969 and are still alive at this writing.

Main sources of food have been cut beef lungs, meal worms, and artificial lights to furnish natural food.



These are tadpoles produced in the commission's frog rearing project at Beechwood hatchery.

It appears from preliminary observations in stocking rates that bullfrogs will not survive under crowded conditions such as commercial fish, etc. exist. This is probably due to more than one reason, such as being highly carnivorous, demand a certain minimum space for domicile, etc.

Researchers plan to expand certain phases of food sources as well as stocking rates as soon as expansion of facilities and personnel permit.



Bullfrogs were pen-raised to a healthy size at Beechwood.

## FARM PONDS

**SAMMY STOKES**  
Fishery Biologist

The farm pond project was operated in the same basic capacity as it was originally set up.

It was carried out largely as an extension type service to pond owners interested in managing farm ponds for sport fishing.

There was a total of 208 farm ponds checked



An overall view of Beechwood hatchery shows pens used in the frog rearing project.

or stocked during the biennium. These ponds were sampled or stocked according to formal requests of the pond owners. In cases of farm ponds sampled, management plans were presented to the pond owner to correct any problems that might have been encountered.

The major problems in farm pond management are still largely aquatic weeds and over crowding of forage fish. Other major problems were oxygen depletions, fish diseases and parasites and poisonous pesticides. These problems are covered under other fishery reports.

A farm pond evaluation project was initiated in 1967 and terminated in 1968 to determine the success of our farm pond project. One hundred ponds that had previously been stocked by the Louisiana Wild Life and Fisheries Commission were selected to be sampled and evaluated in this project. Results showed that approximately 50% of these ponds contained unbalanced fish populations due to various problems. It was also evident that most of these problems could have been prevented if a few simple preventative steps had been taken by the pond owner prior to stocking, such as being sure that new ponds were completely clean (contain no fish), proper pond site selection, proper pond construction and an adequate pond fertilization program. These basic steps would have curtailed introduction of wild

fishes and marginal and submerged weed growth. However, the blame does not entirely lie with the pond owner but shortage of time, money and personnel make it impossible to carry out a complete and accurate farm pond project with other duties that exist.

Any person interested in stocking or initiating a sport fish management plan for his farm pond should contact his local Louisiana Wild Life and Fisheries Commission district office for formal application. Upon return receipt of his application proper steps toward his pond will be taken.

## EXOTIC SPECIES INVESTIGATIONS

**ARTHUR M. WILLIAMS**

Fishery Biologist

In the last several years fishery biologists have come to realize that the best fishery management plans are those that most resemble natural conditions. For example, the annual draw down, which is a very important management tool, is simply a duplication of the natural water level fluctuation which took place annually before man began altering the landscape with projects such as drainage, etc.

Along these lines, some most important problems have been the extremely high fish population densities reached in some lakes, the encroachment of obnoxious weeds in some lakes and streams, and the stunted fish populations which are the result of these problems.

The draw down is an important tool to combat these problems, but it can have some undesirable problems associated with it. Chemical control of weeds and overcrowded fish populations has been successful in some areas, but is extremely expensive.

It was after weighing all of the above information that it was decided to experiment with another approach, that being biological control, i.e., do something that would alter the ecosystem in such a way to produce the results desired. It was decided to attack the problems of over population and obnoxious weeds.

The problem of obnoxious weeds was attacked by starting investigations on herbivorous fish (plant eating fish). Two species tried, Israeli carp and Tilapia. The Israeli carp was found to be unsatisfactory and was discarded during 1966. Investigations with the Tilapia were carried into the biennium covered by this report.

The second problem attacked was that of overpopulation of certain forage species, specifically the shad.

The recent success of other states dealing with the striped bass and the walleye were encouraging. Hence, Louisiana began investigations with these two species in 1965. The thinking behind



Commission personnel stock one of the 208 farm ponds in Louisiana, this one with bluegill.

the introduction of these fishes was that two large predators would be available to forage on the large populations of shad which are not now being used by native species. Aside from this, these additional species occupy separate niches which only slightly overlap with native species. In other words, the striped bass and the walleye live in separate areas of the lake, the walleye at the bottom and the striped bass associated with the surface of open water areas. The largemouth bass and the crappie spend most of their time close to the shore and underwater objects. For this reason, it was felt that the program was adding fish that would feed on shad in the deeper water at the bottom and fish that would take shad in open water near the surface. Also important, the striper and walleye reach a larger size than do the largemouth bass or the crappie, so it was also hoped that they would prey on the 15 to 20 inch shad which are now unused.

Studies are discussed individually and in greater detail in this report.

### Striped Bass

Since 1965, Louisiana has been engaged in the rearing and stocking of striped bass in our lakes and streams. The striped bass has long been known as a great game fish along the East Coast and to a lesser extent in the Gulf of Mexico. Typically, the striped bass is an anadromous species, i.e., it lives in salt water and reproduces in fresh water. In South Carolina, however, a population of these fish has become land locked and has been living and reproducing entirely in fresh water. This event is quite exciting to fishery biologists for two reasons. One, the striper sometimes reaches a size of approximately fifty pounds in fresh water and thus is a tremendous game fish and, second, while attaining this large size it takes as food the larger forage fish which otherwise would go unused in a lake. In other words, the striped bass offers the sportsman a good game fish that, because of its open water habits, does not compete with native game species and it also offers the fishery biologist a tool by which he can control the explosive shad populations in Louisiana.

During the biennium 1968-69, Louisiana received 3,165,000 striped bass from South Carolina. This number may seem large, but actually it is small when it is considered that one adult female striper can produce as many as 1,200,000 eggs and, because of this high fecundity, a high rate of mortality can be expected. In order to be successful in these efforts, biologists must know as much about these fish as possible. A portion of this number is stocked in rearing ponds for restocking in lakes and streams. A portion is retained for studies such as holding techniques, feeding experiments, and bioassay studies.



A striped bass recovered from commission rearing ponds to be stocked in Lake D'Arbonne.

For stocking purposes, 2,073,000 fry were placed in rearing ponds and 220,700 were recovered and stocked in Louisiana waters. This is a survival rate of 10 per cent. Some 149,779 fish were stocked in Lake D'Arbonne, and 36,750 were stocked in Toledo Bend, whereas 32,500 fish were returned to South Carolina, as initially agreed upon.

The Commission also stocked stripers in the Biloxi marsh in hopes that it can re-establish the population which once was present in Lake Pontchartrain.

Results of the striper project are just now being felt. The largest confirmed report we have to date is a 12 pound female which was taken in the Sabine River north of Toledo Bend. This fish was gravid and evidently was making a spawning run. By far the most reports have come from Lake D'Arbonne, fish ranging from 23 grams to 8 pounds have been taken in population studies. Reports of large fish being taken by sportsmen are common. Some of these reports have it that 10 pound fish have been taken. In addition to fish that have been taken in D'Arbonne and the Sabine River, stripers have been taken in Black River at Jonesville and the Mississippi River at Deer Park.

While these results are a long way from a self-propagating population, they are very promising and the future for the striper looks bright in Louisiana.

### Walleye

The walleye, while not native to Louisiana, has been taken in Louisiana on occasion. It is however, present in Arkansas and some other neighboring states. For these reasons it was felt that the walleye might be successfully introduced into Louisiana waters and add not only another important game species, but also an effective tool in fishery management.



Walleye, a species with exciting angling potential for Louisiana, has been stocked in Lake D'Arbonne.

Walleye differ from striped bass considerably. They are a totally fresh water species and, instead of being pelagic (open water forms) as are stripers, they are closely associated with the bottom, and usually deep water.

Rather than receive live fry, as in the case of the stripers, the section received fertilized eggs from Nebraska and hatched them. These eggs take approximately a week to hatch.

During 1968 and 1969, Louisiana received 3,848,000 eggs from the state of Nebraska and stocked approximately 60,000 fingerlings. This low percentage of survival was due not to an unsuccessful hatch, but some problems due to handling.

Most of the walleye have been stocked in Lake D'Arbonne. There are presently 27 confirmed reports of walleye being taken from Lake D'Arbonne. These fish range from 0.5 to 1.5 pounds. There are many unconfirmed reports, however, which are impossible to check, but it is felt that at least a portion of these are probably correct.

The return is not too great, but it must be remembered that angling for walleye takes special techniques, techniques which are not at all common in Louisiana. For this reason, it is believed that once the sportsman is aware that this game species is available, the returns will pick up. Also, it is possible that present sampling methods are inadequate. Studies are being made to determine whether or not this is true or if the walleye population is limited.

## Tilapia

All studies which dealt with tilapia were terminated early in 1969. Originally it had been hoped that the tilapia would be a satisfactory control for obnoxious weeds, but it was determined that the population density required to attain this control was impractical. In other

words, tilapia can control some species of aquatic vegetation, but in so doing they must become so abundant that they alter the natural balance in the ecosystem by crowding out native species. Also, tilapia are extremely sensitive to low temperatures and must be over-wintered. They stop feeding at temperatures below 60 degrees and die at temperatures below 48 degrees. In addition, tilapia do great damage to the lake or stream bottom when they spawn. They build extremely large, deep nests. This practice alters the bottom so that native species are forced to seek less desirable habitat for their spawning activities. Because of the above problems, the tilapia program was given up in favor of programs with striped bass and walleye.

## Anadromous Fish

During the last biennium, Louisiana completed an anadromous fishery project. The purpose of this project was to investigate the ecological factors affecting anadromous fishes of Lake Pontchartrain and Lake Borgne. An anadromous fish is one which migrates to fresh water to spawn, but which spends part of its life in salt water.

This project was closely associated with studies which are currently being carried out dealing with striped bass.

Three species classified as anadromous fish were once present in Louisiana, the striped bass, the Atlantic sturgeon, and the Alabama shad. Most emphasis was placed on efforts to locate at least remnants of a striped bass population. This project was carried out in three parts; one—the sampling of Lakes Pontchartrain, Borgne, and Maurepas; two—the sampling of the tributary streams. In this manner it was felt that biologists had a full grasp of what was present in the vicinity of the coastal streams.

In addition to this sampling, approximately 8,000 striped bass fingerlings were released in the Tchefuncte River. None of these fish were ever recovered.

No striped bass were taken during the study, while representatives of the other two anadromous species were taken. Only two specimens of the Alabama shad were taken, however. A good population of Atlantic sturgeons was located with specimens ranging from 6 inches to 75 inches being taken.

The reason for the disappearance of the striped bass was not discovered. Efforts are now being made to re-establish a striped bass population through stocking fingerlings in the Biloxi marsh.

Complete results of this project will be published at a later date in both popular and scientific journals.

## SPOTTED BASS

**DUDLEY C. CARVER**

Fishery Biologist

Louisiana has many miles of streams, rivers and bayous which provide many man-days of sport fishing recreation. The cool water, gravel bed streams in Louisiana support good populations of fish of a variety of species. The most popular fishes in these streams that are sought by fishermen are bream, bass and catfish.

Fishing pressure on streams in the past was mainly by local residents living near the stream. They fished mostly from the bank or by wading the stream. During the past two decades fishing pressure on these streams has increased tremendously. This increase resulted from people in nearby metropolitan areas seeking relief from crowded reservoirs and the aesthetic quality afforded by fishing "wild" habitat. A new method of fishing these streams, known as "float fishing" also had its beginning during the past two decades. A party of two people float the stream in a canoe or special designed "float boat"; one paddling while the other fishes.

Today, the most popular fish sought by Louisiana stream fishermen is the spotted bass. Impoundments have been constructed on many Louisiana streams that once supported excellent populations of spotted bass. In many cases, spotted bass completely disappeared from the im-



Fisheries personnel taking seine samples in Six Mile Creek to determine foods available in conjunction with foods eaten study of spotted bass.

pounded reservoir fishery while in other reservoirs they maintain only a meager perpetuating population. With the decline of native spotted bass habitat and many reservoirs planned for the future on prime streams it was deemed necessary to begin a life history study of the spotted bass.



Collecting a benthos sample from Six Mile Creek.



Field washing benthos sample collecting from Six Mile Creek.

Six-Mile Creek, which flows through portions of Vernon and Allen Parishes was chosen as the study area for this project. This stream has no history of any major pollution and exists today in its nearly natural state.

The general objective of this study is to gain knowledge of spotted bass in its natural environment. The long range objective is to take obtained knowledge from this study and follow up with a study of a reservoir constructed on a stream that had a good population of spotted bass. It is hoped in this phase of study we will learn what factors are adversely affecting spotted bass in Louisiana impoundments.

This study has the following job objectives:  
To determine rate of growth and coefficient of condition; determine gonadal development, fecundity and time of spawning; make stomach content analyses and compare foods eaten with samples of foods available; determine movement and indices of abundance per stream mile; determine if a correlation exists between these factors and the physical and chemical conditions of the stream.

Results of findings for this biennium follow closely those reported in the past biennium. The sampling stations for collecting fish and water chemistries remained the same.

A total of 392 spotted bass have been collected for age and growth determination. Results are incomplete for this report but preliminary results indicate the possibility of six age groups with



Spotted bass project leader, Dudley Carver, identifies food organisms from seine samples at the Lake Charles laboratory.

two year old fish being the dominate age group. Spotted bass in Six-Mile Creek are in excellent body condition and coefficient of condition K agrees well with the works of Bryan (1964) for spotted bass from the Ohio River.

A total of 350 spotted bass stomachs have been analyzed for foods eaten. Sixty-eight per cent of the stomachs examined during this biennium contained food. The dominant food eaten was the crawfish, *Procambarus dupratzi*. In only three of 13 samples examined did crawfishes constitute less than 75 per cent of the total food volume.

Studies of reproduction during this biennium was hampered by high stream water levels during peak spawning season. This situation prevented vital collection of mature females for this



Installing a continuous recording thermometer in Six Mile Creek to determine water temperature at time of peak spawning of spotted bass.



Running hoop nets set in Six Mile Creek. This sampling was done to determine relative abundance of other fishes associated with the spotted bass.

portion of study. Peak spawning probably occurs between May 15 and June 15. Mean weekly water temperatures during this period ranged from 67.0° to 72.0° F. Sex ratio of males to females of 192 spotted bass examined was 1:1.40.

No work on movement of spotted bass or population estimation was accomplished during this biennium due to a shortage of personnel needed to carry out field work.

Field water chemistry analyses were conducted monthly at all stations and water samples were collected monthly at all stations for laboratory analyses. Water temperatures and turbidity appear to have the greatest apparent effect on spotted bass in Six-Mile Creek. No definite conclusion will be drawn concerning correlation of chemical properties of the stream and life history data of the spotted bass until conclusion of the complete study.

## STREAM PRESERVATION

**GLADNEY DAVIDSON**  
Fishery Biologist

Stream preservation is a new word and a new idea in Louisiana. The need for stream preservation can be seen only if one views the state as a whole. The loss of a stream in one section of the state usually has little or no effect on other sections of the state; therefore, the citizens of the areas not affected have little concern. In surveying the state, fishery biologists were alarmed to find only a few streams, rivers, or bayous that remain in their natural and scenic conditions which we consider worthy of preserving.

When one thinks of Louisiana history he immediately remembers "ole man river," "the Mississippi River boats and gamblers", and cannot



Six Mile Creek—a stream worthy of preserving in its beautiful, natural state.

help but think of Bayou Teche and the Cajun country. Today, those streams have been altered or damaged to such an extent that they offer no real scenic or aesthetic values. Within the past biennium, the realization that Louisiana is about to lose most of its natural and scenic bayous, streams and rivers due to various flood control and drainage projects has made the need for this program more acute. The concept of stream preservation is not only new to Louisiana but also new to the nation as a whole. It has been less than 10 years since the idea of preserving the nation's wild or scenic rivers was first introduced. In 1968, less than a year ago, the concern of many people over the alteration of the rivers and bayous throughout the nation was reflected in the adoption of the National Wild Rivers Act by Congress. Many of the states have attempted to complement the national program by adopting state scenic river plans. Thus far, only Tennessee has succeeded. We hope the following biennium will see the adoption of a scenic rivers plan in Louisiana. Essential elements in any scenic stream plan must be the establishment of a conservation corridor and the prohibition of stream and stream bank degradation.

The primary function of fishery biologists in Louisiana is to conduct research on needed phases of fisheries, wisely manage the fisheries resources of the state and protect and preserve fisheries habitat and endangered species. Stream habitat unaltered by man is rapidly disappearing in Louisiana. We believe it is Commission duty to preserve some of the better streams in Louisiana for future generations. Talks which presented the need and the basic elements of a stream preservation program were presented on numerous occasions.

## CRAWFISH

**CECIL LaCAZE**  
Fishery Biologist

Louisiana's unique crawfish industry has constituted an important part of our economic, social and recreational life for many years. Since 1959, the supply of crawfish from natural areas has been supplemented by a rapidly growing number of crawfish farms. Land devoted to crawfish farming has increased to approximately 12,000 acres.

The Crawfish Project primarily provides assistance to crawfish farmers. Advice and assistance are given on matters ranging from selection of suitable areas for crawfish ponds to marketing suggestions. Consultations involving water management, fish control, vegetation, pesticide effects and many other factors are held at pond sites. During the past two years a total of 153 visits have been made to existing or prospective crawfish farms. Management practices



Australian crawfish is one of several species being considered for cultivation in Louisiana.



which evolved from these visits have been applied to management plans for natural areas. These plans, if implemented by the U. S. Corps of Engineers, will provide a considerable amount of sport crawfishing on Lake Pearl in Avoyelles Parish and in the Bonnet Carre Spillway near LaPlace.

The most rapid increase in crawfish farming acreage is occurring near Pecan Island in slightly brackish marshland. Research is being conducted on the tolerance of crawfish to salt water. Findings indicate that many thousands of acres of more brackish marshland is suitable for crawfish farming.

Research is being conducted on cultivating larger crawfish for foreign markets. Seafood dealers in France, Denmark and Sweden require larger crawfish than those acceptable in the Louisiana market. Limited research has been conducted on one species of Australian crawfish,

which attains a maximum weight of four pounds. Plans are underway to obtain more specimens for continued experiments with this species. One cooperating crawfish farmer is using native red swamp crawfish in a selective breeding experiment. The goal of this experiment is to obtain larger and faster growing crawfish.

A systematic sampling program was initiated on one typical crawfish pond. The most significant finding in this study verified that harvesting of crawfish in November and December is a sound practice. Many adult crawfish not harvested during this period will reach the end of their life spans and die before the normal spring harvesting season. Data from this and other studies also indicate that an enforced season on crawfish, wild or cultured, cannot be biologically justified.

Other project activities included television programs and news articles promoting crawfish; assisting in the school workshop programs with lectures on general fisheries activities and in conducting national and foreign correspondence on many matters pertinent to crawfish.

## FISH KILLS AND DISEASE PROBLEMS

**KENNETH E. LANTZ**

Fishery Biologist

Increased production of pond raised catfish and bait shiners during recent years has resulted in numerous incidents of disease and parasite outbreaks. During the 1968-69 biennial period fisheries biologists investigated fifty-three parasite cases and twenty bacterial disease cases in pond raised fish. Twenty-two incidents of fish loss due to oxygen depletion, five pesticide kills and one incident of fish loss due to a bluegreen algae bloom were investigated in farm ponds.

Numerous losses of fish in natural bodies of water were also investigated by fisheries personnel. Seventeen cases of fish kills due to oxygen depletion, two cases due to bacterial infections, two cases due to pesticides and thirteen losses due to industrial waste were investigated during this biennial period. Fishery biologists also worked with the Pollution Division personnel in other fish kills in our lakes and streams. These cases are reported in this publication by the Pollution Division.

Recent interest in the propagation of commercial fish in ponds has placed an increased load on the services of state and federal fisheries personnel. Once a person begins commercial fish farming, he is subjected to all types of production problems. One of his most common problems will be incidents of fish loss due to disease, parasites and natural conditions when increased productivity is sought. If a fish parasite or disease problem is suspected, early recognition of infection of the fish is imperative if identification and treatment of the condition is to be properly made.

A fishery biologist should be contacted immediately to insure survival of the fish crop. District fisheries personnel have been trained in recognition of most common disease and parasite organisms. If an unusual organism is encountered, the biologist can forward affected fish specimens to Auburn University or the Stuttgart Fish Laboratory for further assistance. The important thing is that the condition be recognized early and treatment begun as soon as identification is complete.

## RIVER BASINS

**GLADNEY DAVIDSON**

Fishery Biologist

During the past eight years, over 1,013,577 acres of Louisiana's forests have disappeared and along with them several thousand miles of streams, bayous and rivers. With this loss of habitat, there has also been a reduction in the fish and wildlife potentials of these areas. Projected figures indicate that in the north Louisiana bottomland areas, the deer potential will be reduced from 126,076 deer in 1968 to less than 31,550 by 1985. This indicates a loss of some 762,700 days of deer hunting—or 75 percent loss. Similar results can be applied to squirrel, rabbit, turkey and waterfowl.

Commercial and sport fishermen know that the fish populations in altered streams and rivers are not what they used to be. Research has indicated that once a stream is altered by channelization the fish population is reduced by 90 percent, both in weight per acre and in numbers of fish per acre.

While the losses quoted above are staggering, without the coordination, investigations, evaluations all proposed federal and many state projects the losses would have, without a doubt, been much larger.

As projects are planned and initiated, they are studied and reviewed by the River Basin Section. Upon completion of these studies recommendations are prepared and submitted to various concerned agencies and individuals. Almost all projects which involve water or forested areas will have some effect on fish and wildlife. In many instances, recommendations were made that modified the projects. This often minimizes the damages to or enhances the fish or wildlife resources. Some projects that would be excessively damaging to the natural resources were opposed.

An example of a River Basin accomplishment was the raising of the Interstate Highway 10 Bridge across Blind River from an elevation of eight feet above mean high water to an elevation of 25 feet above mean high water, thus allowing continued access under the bridge for houseboats, pleasure boaters, and fishermen.

Other projects upon which the River Basin biologist has worked during the past biennium are as follows:

*United States Army Corps of Engineers*

Mississippi River at Venice  
Comprehensive Basin Study, Red River Below  
Denison Dam  
Sabine River Basin Comprehensive  
Bogue Lusa and Coburn Creeks  
Choctaw Bayou and Tributaries  
Eastern Rapides-South Central Avoyelles Parish project  
Lake Pontchartrain, North Shore  
Lake Pontchartrain and Vicinity  
Calcasieu River at Devil's Elbow  
Petit Anse, Tigre and Carlin Bayous  
Red River Backwater (Tensas-Cocodrie pumping station)  
Gulf Intracoastal Waterway in Vicinity of Butte  
Catahoula-Charenton Area  
Atchafalaya Basin  
Gulf Intracoastal Waterway, East of the Mississippi River-Gulf Outlet and Michoud Canal  
Plaquemine Lock  
Levee improvements in Vicinity of Simmesport  
Upper Point Coupee Loop  
Brush Bayou  
Old River Control Structure (Atchafalaya Basin)  
Sherburn Freshwater Diversion structure (Atchafalaya Basin)  
Brushley Bayou Area  
Old and Atchafalaya Rivers, Louisiana (Atchafalaya Basin)  
Pearl River Basin Comprehensive  
Holly Beach Project  
Bayou Bartholomew and Tributaries

*Soil Conservation Service*

Coastal and Independent Streams  
West Madison Watershed  
Central Madison Watershed  
Cameron-Creole Watershed  
English Bayou Watershed  
Bossier and Webster Parish RC and D Project  
Port de Luce Watershed  
Chatlin Lake Watershed  
Walnut-Roundaway  
Avoyelles-St. Landry Watershed  
Eastern Rapides South Central Avoyelles Watershed  
Bayou Blue Watershed  
North Concordia Watershed  
Bayou Black Watershed  
Lake Verret Watershed

*United States Coast Guard*

Eleven applications to the Coast Guard for permits to build bridges across navigable waterways were reviewed and commented upon.

*Louisiana Department of Highways*

Some 84 Louisiana Department of Highways projects were reviewed for their effects upon fish and wildlife resources and habitat recommendations made to minimize damages to or to enhance these natural resources.

## BLUE CRAB

**BENNIE J. FONTENOT, JR.**

Fishery Biologist

The following report is a study of the adult blue crab population located in the coastal estuaries of Southeastern Louisiana. Facts concerning occurrence, abundance, adult size classes, catchability, spawning periods, spawning grounds, movements, mating periods and mating grounds of the adult blue crab in this particular area are discussed.

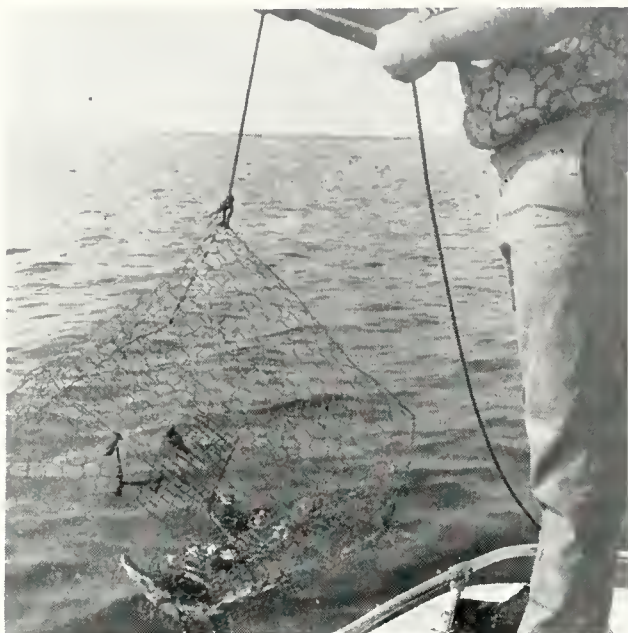
All of the samples used in this report were collected in the estuary that lies between the Mississippi River and the Mississippi River-Gulf Outlet. It is bordered to the south by Breton Sound and to the north by higher ground containing the municipalities of Reggio, Hopedale, Shell Beach and Yscloskey.

The estuary is approximately 25 miles in length and width, and it contains large lakes (6 ft. depth mean tide level), shallow lagoons (2-3 ft. depth mean tide level) and many blind ponds. The marsh is traversed by a maze of winding bayous which connect the larger bodies of water to each other.

Most of the waters in the estuary are brackish becoming saline at times in the more southern areas. The lowest salinity recorded during the study was 8.5 parts per thousand in the northern section and highest recorded was 25 parts per thousand in the southern section.



View of typical commercial blue crab trap used in study area.



View depicting the raising of a commercial blue crab trap.

The temperature range recorded was 50°F in January, 1969 and 89.6°F in August, 1968.

The marsh land is typical of most brackish marsh areas with *Spartina sp.* present as the dominant plants. Aquatic vegetation is composed mainly of widgeon grass, *Ruppia maritima*.

Collections were made using duplicate commercial blue crab traps set in three areas—Hopedale Lagoon Area (northernmost), Lake Robin area (middle section) and the Rock Jetty Area (southernmost section) near the mouth of Black Levee Canal. Sampling period was July 1, 1968 to June 30, 1969.

The traps were set for a 24 hour period once each week and baited with fish. All blue crab specimens captured were measured (carapace) length in inches, and sexed. The average catch per effort was calculated for each set during a particular month at each station.

Nine hundred and thirty-two blue crabs were captured during the study period. Blue crabs appeared in the estuary during all months sampled. Peaks in catch per effort occurred during November and December, 1968 and January, 1969 in the Hopedale Lagoon Area; and in December, 1969 in the Lake Robin area. No significant peaks occurred in the Rock Jetty Area.

The sizes of the blue crabs captured most numerous were the 6 inch class (25.4% of the population), the 6.5 inch class (26.6% of the population), and the 7 inch class (17.9% of the population). The 5.5 inch class composed 12.5% of the population. The largest blue crab captured was 8 inches. Only two of this size were captured during the entire year.

Males constituted 80% of the total catch (all locations combined).

The number of females were greater within the estuary during the fall, winter and spring periods. During June through August, the female population became drastically reduced and almost disappeared from the sampling areas. It is felt that during this time the females have migrated into the more saline waters of Breton and Chandeleur Sound and the Gulf of Mexico to spawn. The male population remained within the estuary during the entire study.

After making a literature review, it was found that other blue crab studies indicated that a salinity of at least 21 parts per thousand or greater required for blue crabs to spawn. The salinity range recorded at the Rock Jetty Station located on the northernmost border of Breton Sound was 15 ppt–25 ppt. Waters then become more saline as one goes in a southerly direction toward the section of the Sound and into the Gulf of Mexico. The salinity range recorded within the estuary was 8.5 ppt–18 ppt.

Previous to the spawning migrations, the estuary plays an important role as a mating ground. Males and females were observed frequently clasping or in the “double-condition” during the spring and fall periods. Exact records of such observations were not kept regularly due to pressures of other work.

\* Blue crabs less than 4” would not generally be held by the trap because of the large mesh used in its construction.

## SPORT FISHERIES IN COASTAL WATERS

BENNIE J. FONTENOT, JR.  
Fishery Biologist

The purpose of this project is to give to the sportfishermen pertinent biological information of the salt water sport fish in the estuaries, bays and coastal lakes of Southeastern Louisiana.

Fishes were collected with a 200 yard trammel net, 16 ft. otter trawl and 8 ft. bobbinet. Each individual species captured was identified, weighed, and measured, and then correlated to date, water temperature, tidal condition and salinity existing at the time of its capture. Its stomach contents and gonadal conditions were also examined and recorded.

Of the game fish collected, those most avidly sought after by the salt water sportsmen are the spotted seatrout (speckled trout), *Cynoscion nebulosus*; the red drum (redfish) *Sianops ocellata*; southern flounder, *Paralichthys lethostigma*; black drum, *Pogonias cromis*; sheepshead, *Archosargus portoaphalus*; and, the Atlantic croaker, *Micropogon undulatus*.

The spotted seatrout, red drum, black drum, and sheepshead appeared rather consistently

throughout the year, although fewer in numbers during certain periods. During particular tidal conditions and water temperatures these fish would move from the shallow lagoons, bays or lakes to the deeper bayou or canal waters within the estuary.

The atlantic croaker and spot became drastically reduced from the shallow lagoon and lake waters during the winter months and did not reappear in significant numbers until early spring becoming numerous thereafter.

A more complete analysis of all data collected is presently being computed in the Louisiana Wild Life and Fisheries Commission computer laboratory in Baton Rouge. Such information as food habits, spawning periods, movement patterns, seasonal distribution and abundance, and the effects that tides, water temperatures, and salinities have on these parameters will be discussed. This information will be published in a separate publication and presented to the public free of charge on July 1, 1970. This information will serve as a guide to sportfishermen so that their catch and outing will be more successful and enjoyable.

## Game Section

**CHARLES R. SHAW**  
Supervisor

**ROBERT E. MURRY**  
Asst. Supervisor

The normal activities of the Game Section include research, development and management of all resident and migratory species of game to be found in Louisiana. There is also an active program dealing with various exotic game species such as the Black Francolin and Red Junglefowl.

The Game Section includes all of the "Pittman-Robertson Section", (Federal Aid in Wildlife Restoration) and additional personnel who are involved only in activities financed wholly by state funds. All work together in an integrated statewide program of game management and research furthering the aims and policies of the Louisiana Wild Life and Fisheries Commission.

Since the conservation and enhancement of natural resources for their utilization by the present and future sportsmen of Louisiana is one of



This is a typical scene of Louisiana Wild Life and Fisheries Commission personnel taking a 200 yard trammel net sample in an estuary of Southeastern Louisiana.

the overall aims of the Fish and Game Division, the acquisition and operation of game management and public shooting areas is one of the primary duties of the game section. An abbreviated report on this follows later.

## PREDATOR CONTROL

### T. E. HARRIS

The Predator Control Section is composed of six trappers and one supervisor.

#### January through December 1968—Nine trappers

|                  |     |
|------------------|-----|
| Skunks .....     | 297 |
| Coyotes .....    | 383 |
| Housecats .....  | 87  |
| Foxes .....      | 637 |
| Bobcats .....    | 104 |
| Beavers .....    | 68  |
| Feral Dogs ..... | 139 |

#### January through November 1969—Six trappers

|                  |     |
|------------------|-----|
| Skunks .....     | 136 |
| Coyotes .....    | 303 |
| Foxes .....      | 618 |
| Housecats .....  | 37  |
| Bobcats .....    | 78  |
| Beavers .....    | 75  |
| Feral Dogs ..... | 91  |

The number of trappers for 1969 was reduced by three. Coyotes and beavers demand more of our attention than any other species. Both continue to increase in numbers and inhabit more areas of the state.

The coyote is a very prolific animal, almost impossible to capture except by trained trappers. They use a wide variety of food items, from baby calves and deer to mice, persimmons, watermelons, etc.

Beavers also are very prolific and are found statewide except in the coastal marshes. Most of our beaver complaints come from timber interests who experience considerable losses by flooding or girdling.

Rabies among foxes and skunks has demanded our attention with practically all of the cases occurring in the north central part of the state.

Following is a list of cases of rabies confirmed by the State Health Department.

#### 1968

|                 |    |
|-----------------|----|
| Dogs .....      | 10 |
| Foxes .....     | 23 |
| Skunks .....    | 4  |
| Bats .....      | 2  |
| Housecats ..... | 1  |
| Hogs .....      | 1  |
| Total .....     | 41 |

#### 1969—January through November

|              |    |
|--------------|----|
| Dogs .....   | 4  |
| Foxes .....  | 27 |
| Skunks ..... | 4  |
| Bats .....   | 4  |
| Total .....  | 39 |

Trappers are also used on alligator tagging projects, managed deer hunts, collections of animals, skulls and stomachs for scientific studies, etc.

## RESEARCH DESIGN, MACHINE COMPILATION AND ANALYSIS OF DATA

### ROGER HUNTER

Electronic data processing has been instrumental in the analysis of a number of Fish and Game and other Commission programs during 1968 and 1969. Work accomplished or in progress during this period falls within three major categories as follows: (1) wildlife surveys, (2) bird banding and (3) service programs.

### Wildlife Surveys

Results from these surveys are presented in brief by species under the appropriate sections of this biennial report.

#### DEER KILL

Deer kill mail surveys were conducted on a parish (county) basis for the 1967-68 and 1968-69 seasons. Timely computer estimates for these surveys have provided valuable management information for our biologists and the Commission.

Samples of big game licenses and permits are drawn at random from each parish for this survey. Total questionnaires mailed for the 1967-68 season were 20,102 and 23,767 for 1968-69. The response rate was approximately 70 percent for each survey.

#### DOVE HARVEST

Dove harvest mail surveys were conducted on a statewide basis for both the 1967-68 and 1968-69 seasons. The frame used was the Louisiana basic hunting license issue. The primary purposes of this survey are to obtain names and addresses of Louisiana dove hunters to be used in conjunction with a regional dove telephone survey and to verify the Louisiana results obtained from the regional survey. The sampling rate used was 3 1/3 percent or 10 random license numbers from each three hundred licenses issued.

#### SMALL GAME

A resident small game mail survey including squirrel, rabbit and quail for the 1967-68 hunting season was completed in 1968. This survey

will be repeated within four or five years. The frame and sampling rate used were the same as that used for the dove survey.

### WATERFOWL SURVEY

The first Louisiana waterfowl kill mail survey was completed by the Commission in 1969 for the 1968-69 season. The results of this survey were satisfactory and a 1969-70 survey is now in progress which will also reflect the results of the early September teal season. The Louisiana basic hunting license was also used as the frame for this survey.

### Bird Banding

Sub-permits are issued to Commission banders from the master bird banding permit obtained from the U. S. Fish and Wildlife Service.

Field banding reports received from our banders and banding and recovery reports received from the U. S. Fish and Wildlife Service are edited, coded and processed by electronic data processing methods. Detailed bird banding reports are prepared by species, banding locations, recovery locations and other pertinent information for Louisiana banded birds and for birds banded outside Louisiana which were recovered in Louisiana. A perpetual bird banding card file from 1949 to date is maintained for data processing of this vital information as required.

### Service Programs

Service programs requiring electronic data processing during the period included creel census, fish population sampling, water quality analysis and a dove recovery study. Findings pertaining to these programs are included under the appropriate sections of this biennial report.

### DOVE RESEARCH

#### LARRY SOILEAU

The 1969 dove hunting season with its experimental bag limit of 18 marks the most ambitious effort in the field of state-federal cooperative dove research in the past 20 years. This experimental relaxation of the bag limit for a two year period is the result of the cooperative efforts of dove biologists from the Southeastern States. This is probably one of the few times in the history of wildlife management when research has been initiated while a wildlife species is still abundant. Research has generally been prompted by a shortage of hunting opportunity.

Although hunters have generally been satisfied with the bag limit of 12 doves permitted during the past several years, the present research study called for a substantial increase in the total kill of doves to determine its effect on the welfare of the dove population. Dove researchers decided

### DOVE KILL SURVEY—License Holders Only

#### 1968-69 Season

#### Summary of Estimates—Statewide

| ITEM                                | ESTIMATE  | 95% Confidence<br>VARIATION % |      | 90% Confidence<br>VARIATION % |      | 80% Confidence<br>VARIATION % |      |
|-------------------------------------|-----------|-------------------------------|------|-------------------------------|------|-------------------------------|------|
|                                     |           | ±                             |      | ±                             |      | ±                             |      |
| Dove Hunters .....                  | 70,141    | 1,966                         | 2.8  | 1,642                         | 2.3  | 1,278                         | 1.8  |
| Days Hunted:                        |           |                               |      |                               |      |                               |      |
| 1st Segment (Sept. 1-15) .....      | 170,215   | 5,464                         | 3.2  | 4,562                         | 2.7  | 3,551                         | 2.1  |
| 2nd Segment (Oct. 19-Nov. 24) ..... | 142,993   | 6,537                         | 4.6  | 5,458                         | 3.8  | 4,249                         | 3.0  |
| 3rd Segment (Dec. 19-Jan. 5) .....  | 82,319    | 5,823                         | 7.1  | 4,862                         | 5.9  | 3,785                         | 4.6  |
| Total Days Hunted .....             | 395,527   | 10,319                        | 2.6  | 8,616                         | 2.2  | 6,707                         | 1.7  |
| Doves Killed                        |           |                               |      |                               |      |                               |      |
| 1st Segment (Sept. 1-15) .....      | 670,021   | 41,588                        | 6.2  | 34,726                        | 5.2  | 27,032                        | 4.0  |
| 2nd Segment (Oct. 19-Nov. 24) ..... | 551,478   | 29,738                        | 5.4  | 24,831                        | 4.5  | 19,329                        | 3.5  |
| 3rd Segment (Dec. 19-Jan. 5) .....  | 319,437   | 18,428                        | 5.8  | 15,387                        | 4.8  | 11,978                        | 3.7  |
| Total Doves Killed .....            | 1,540,936 | 54,346                        | 3.5  | 45,380                        | 2.9  | 35,324                        | 2.3  |
| Telephone in Residence .....        | 57,171    | 9,777                         | 17.1 | 8,164                         | 14.3 | 6,355                         | 11.1 |

### AVERAGE RESULTS DERIVED

#### FROM ABOVE TABLE

|                                   |      |
|-----------------------------------|------|
| Season Dove Kill per Hunter ..... | 22.0 |
| Season Efforts per Hunter .....   | 5.6  |
| Dove Kill per Effort:             |      |
| 1st Segment .....                 | 3.94 |
| 2nd Segment .....                 | 3.86 |
| 3rd Segment .....                 | 3.88 |
| Season .....                      | 3.90 |

that a bag limit increase would most likely increase the total kill of doves throughout the eastern United States. Therefore, surveys to estimate the total kill, mortality, reproduction and size of the population were set up beginning in 1966 to determine these measurements with a 12 bird bag limit. During the 1966, 1967, and 1968 hunting seasons these surveys estimated a total kill of 20 million doves annually in the Eastern Management Unit (approximately two million in Louisiana) from a preseason population of 150 million doves.

The size of the kill resulting from this year's increased bag limit and its effect on the population will not be known until surveys are complete this spring. The Commission may then begin to better understand the role of hunting regulations in the management of this migratory bird.

This study is a giant step toward attaining the goal of maintaining the population in a productive state which will provide continued good hunting along with all the other kinds of enjoyment that the dove provides.

### 1968-69 Season

#### DOVE KILL SURVEY

##### Sampling and Responses

Frame Used—1967-68 issue of Louisiana Basic Resident Hunting Licenses

Total Issue—311,464

Sampling Rate—1 $\frac{2}{3}$ % (5 random license numbers from each 300 licenses)

Total Questionnaires mailed ..... 4,838

Non-Contactables ..... —351

Effective Sample Size ..... 4,487

Responses to First Mailing ..... 1,974 (44.0%)

Responses to Second Mailing .... 770 (17.2%)

Responses to Third Mailing ..... 397 ( 8.8%)

Total Responses ..... 3,141 (70.0%)

Non-Responses ..... 1,346

Effective Sample Size ..... 4,487

Various comparisons between the 1967-68 and 1968-69 survey results are as follows:

Total dove hunters decreased by 14,666 (17.3%) from 84,807 to 70,141.

Total dove killed decreased by 525,884 (25.4%) from 2,066,820 to 1,540,936.

Total efforts decreased by 85,430 (17.8%) from 480,957 to 395,527.

Average efforts per hunter decreased slightly from 5.7 efforts to 5.6 efforts.

Average kill per effort decreased from 4.3 doves to 3.9 doves.

#### WATERFOWL RESEARCH

HUGH BATEMAN

1968-1969

##### Waterfowl Inventory

Waterfowl inventories have always been one of our most important obligations as a wildlife agency. A revised method of estimating numbers of ducks in Louisiana's coastal marsh and rice land was implemented in September, 1968. This new method is designed to measure major

changes in the numbers, kinds and distribution of ducks that are transient to and winter in this area. The technique is based on a system of 27 north-south transect lines that run parallel to each other between U. S. Highway 90 and the Gulf of Mexico. These lines are flown in a Cessna 210 once each month from an altitude of 75 to 100 feet and an air speed of 90 to 100 mph. Numbers and species of ducks seen within  $\frac{1}{8}$  mile on each side of the aircraft are recorded on portable tape recorders by the biologist and pilot. This allows coverage of approximately three percent of the total census area. The numbers of each species recorded are then expanded by simple proportion to arrive at an estimated total for the entire inventory area.

In addition to the transect portion of the waterfowl inventory total count estimates of ducks are made on Catahoula Lake and on scaup populations in off-shore waters of the Gulf of Mexico.

Completed inventories are mailed to over 200 interested persons. A written statement is supplied on the back side of each inventory report that points out current situations affecting that particular inventory. Table I lists the results of the 1968 and 1969 mid-winter waterfowl inventories which cover the entire state and include estimates of all waterfowl (ducks, geese and coots).

Table I

#### LOUISIANA MID-WINTER WATERFOWL INVENTORIES\*

1968-1969

| Species                 | Jan. 15-19,<br>1968 | Jan. 6-11,<br>1969 |
|-------------------------|---------------------|--------------------|
| Mallard .....           | 380,000             | 308,100            |
| Black Duck .....        | 8,500               | 500                |
| Gadwall .....           | 754,000             | 938,000            |
| Baldpate .....          | 575,000             | 373,000            |
| Green-winged Teal ..... | 536,000             | 1,077,000          |
| Blue-winged Teal .....  | 131,000             | 46,000             |
| Shoveler .....          | 155,000             | 257,000            |
| Pintail .....           | 769,000             | 615,800            |
| Wood Duck** .....       | .....               | .....              |
| Mottled Duck .....      | 63,000              | 70,000             |
| Red-head .....          | 23,000              | 23,000             |
| Canvas back .....       | 15,000              | 19,400             |
| Scaup .....             | 712,000             | 1,354,000          |
| Ringnecked .....        | 63,000              | 184,000            |
| Ruddy .....             | 10,600              | 6,500              |
| Merganser .....         | 4,000               | 20,000             |
| Total .....             | <u>4,199,100</u>    | <u>5,294,400</u>   |
| Canada Geese .....      | 1,700               | 1,300              |
| White Fronted .....     | 26,000              | 21,000             |
| Blue & Snow Geese ..... | 341,000             | 267,600            |
| Total .....             | <u>368,700</u>      | <u>289,900</u>     |
| Coots .....             | 626,500             | 956,000            |
| GRAND TOTAL .....       | <u>5,194,300</u>    | <u>6,540,000</u>   |

\* Estimates state-wide

\*\* Wood Ducks not censused

## WATERFOWL HUNTING SEASONS

### 1968 Season

The 1968 hunting season was typical of recent years as Louisiana hunters were burdened with restrictive regulations, 30 days, 3 ducks and 1 mallard. (The overall reaction to the restrictive regulations was a reduction in duck stamp sales and interest by hunters from the previous year.) Our extremely late opening, December 14, 1968 was not advantageous to marsh hunting, especially in southwest Louisiana but proved helpful to hunters in north Louisiana.

Hunting success on Catahoula Lake in central Louisiana was seriously reduced by high water that drove most puddle ducks from the lake during the season.

### 1969 Season

The 1969 duck season found Louisiana's duck hunting marshes suffering from one of the most severe droughts in decades. Slightly more liberal regulations (40 days, 4 ducks, still 1 mallard) created considerable interest, but dry marshes and ponds severely limited hunting in many south Louisiana areas.

Catahoula Lake experienced much improved conditions over last year as water levels were ideal for ducks throughout most of the season. In turn, most duck hunters enjoyed good success there.

### September Teal Seasons

The Bureau of Sport Fisheries and Wildlife did not allow an early teal season in 1968. In 1969, however, a 9-day season was held from September 13 through September 21. General success was thought to be good and hunter interest appeared to be high. Field reports indicated this season was as good as or perhaps better than the 1965, 66 and 67 teal hunts.

Catahoula Lake was a disappointing area for teal hunting in 1969. A lingering high water that receded just at the opening of the teal season created an unattractive situation to early migrating teal.

## WATERFOWL TRAPPING AND BANDING

### 1968-1969

Banding always rates a high priority and is our most important tool in providing information on the migration, distribution and kill rates of waterfowl. During the fiscal years (1968-69) a total of 8,087 ducks, geese and coots were banded by the Louisiana Wild Life and Fisheries Commission.



Wood duck hen being removed from a wire bait trap for banding. College wildlife students are often employed during the summer for this work. Their employment helps relieve the heavy summer work load on Louisiana Wild Life and Fisheries Commission personnel and they gain valuable field experience in the process.

### A Comparative Study of the G Model, Bell Helicopter and Cessna 210 Aircrafts for Censusing Ducks in Louisiana's Coastal Marsh and Rice Lands

Recent successful use of helicopters in many phases of wildlife work have prompted us to examine its use for censusing waterfowl here in Louisiana.

The information in Table II indicates that the helicopter allowed the observation of significantly more ducks from the air than the Cessna 210. A slower 60 to 70 mph air speed, excellent visibility and the disturbing noise of the engine and propeller of the Helicopter probably account for its superiority. However, the great expense, and limited range of the G Model Bell Helicopter are equally impressive and more important disadvantages.

This information suggests that the present Cessna 210 with relatively inexpensive "slow-fly" modifications to the wing and tail assembly could be greatly improved for waterfowl census work and still be ideally suited for other duties as there is no appreciable loss of cruising speed.

**Table II**

|                                                         | <i>Helicopter</i> | <i>Cessna</i>     |
|---------------------------------------------------------|-------------------|-------------------|
| <i>Total number of ducks seen</i>                       |                   |                   |
| September .....                                         | 4,428             | 2,553             |
| November .....                                          | 61,155            | 44,898            |
| <i>Total flying time required to complete inventory</i> |                   |                   |
| September .....                                         | 22 hrs. 49 min.   | 12 hrs. 45 min.   |
| November .....                                          | 22 hrs. 9 min.    | 12 hrs. 10 min.   |
| <i>Cost of rental*</i>                                  |                   |                   |
| September .....                                         | \$1,307.50        | \$ 520.00         |
| November .....                                          | 1,422.50          | 480.00            |
| Total .....                                             | <u>\$2,730.00</u> | <u>\$1,000.00</u> |

\* Based on estimate of \$40.00/hr. with pilot on Cessna 210 and \$200/day plus \$30.00/hr. on helicopter G-4A Bell Model

## WOOD DUCK ROOST COUNT STUDY

The Louisiana Wild Life and Fisheries Commission and the Cooperative Wildlife Research Unit at Louisiana State University have begun a joint study to investigate the factors that influence the number of wood ducks that use a particular roosting site.

Commission and Louisiana State University personnel selected 44 known wood duck roost sites for study. Starting in July each of these roosts were observed and the number of wood ducks seen recorded. All roost sites were counted on the same day twice a month through December 1969. Starting at 10 minutes before sunset



Wood duck hen being banded at night after a successful roost drive operation. Louisiana State University students and Louisiana Wild Life and Fisheries Commission personnel often work together on trapping and banding jobs.

the number of wood ducks entering a roosting site were recorded by 5 minute time intervals. Weather conditions, water levels, hunting activity and other information were also recorded by each roost observer.

After two years of data have been collected a Louisiana State University graduate student will analyze the information and report his findings.

## EXOTIC GAME BIRD STUDY

**RAY PALERMO**

Study Leader

The Louisiana Wild Life and Fisheries Commission initiated an Exotic Game Bird Study in 1961 when wild trapped black francolins from India were received through a cooperative agreement with the U. S. Fish and Wildlife Service. Since that time the study has been expanded to include work with several species of exotic game birds. These included the red junglefowl, bamboo partridge, Japanese green pheasant, Western Iranian pheasant, and the spotted tinamou.

Since this study was primarily research, the main objective was to test these exotic birds in Louisiana's varied habitats. Black francolins were tested in the low prairie type of the southwestern portion of the state, in old abandoned fields of northwestern Louisiana, in the Red River agricultural region, and in the longleaf pine country of west Louisiana. The black francolin has apparently failed to become established in all areas except the low prairie of southwestern Louisiana. Here it has survived and reproduced well and is presently expanding its range northward.

The red junglefowl from India was also tested in various habitats across the state but failed in all but one. This particular area is Avery Island where it has survived and reproduced in the wild. More time is needed to fully evaluate the final outcome of this release.

Pheasants were liberated in limited numbers in the rice farming area of southwest Louisiana. These birds held on for a while but slowly disappeared. All the reasons for these birds not becoming established are not known but it is felt that suitable winter cover and possibly a scarcity of high quality winter foods are primary factors.

Bamboo partridges were released in limited numbers in 1966-67 but failed to show any promise.

The spotted tinamou was obtained through the Foreign Game Importation Program in 1968. Attempts to rear these birds were made with much difficulty, however a few were produced. No releases were made due to the loss of all breeders.

In summary, it appears that two species of exotic game birds have survived quite well in Louisiana. These are the black francolin and the red junglefowl. The black francolin success is especially significant as it is definitely established

in a portion of southwest Louisiana which is very similar to thousands of adjoining acres. Since work has ceased with exotic species which failed, more effort can be directed toward expanding the black francolin's occupied range in southwest Louisiana. The initial red junglefowl success is encouraging but it is too early to speculate on its establishment. It is also unfortunate that Louisiana does not have more habitat such as Avery Island where the red junglefowl is surviving well.

## DEER RESEARCH

JERRY FARRAR

A keen awareness of the tremendous aesthetic and economic value of our deer herds has led both sportsmen and non-sportsmen alike to place an obligation on the Louisiana Wild Life and Fisheries Commission to insure the continuation of this fine asset for generations to come. To meet this obligation it is essential that this agency develop and continue a sound deer management program based on scientific principles. The key to this program is research.

Deer research in our state has been undertaken in two broad and complex areas of investigation, that of the deer itself and of range it occupies. Many individual studies are involved in each area of investigation. Their results do not necessarily provide for immediate and definite answers to problems of deer management, but serve as part of an overall deer research program designed to create a growing source of information that will be applied to scientific management of deer herds in Louisiana.

Deer studies conducted during the past biennium include a general condition study designed to provide an annual survey of the physical condition of deer on wildlife management areas. Physical data including ages, weights, and antler development are taken each year from deer killed during the managed hunts. This data provide a wealth of information which allows us to keep a close check on herd productivity and physical characteristics of deer from each area. It, therefore, serves as the most reliable criterion by which to measure the success of our management program. Findings of data collected during the past biennium is shown as follows.

Table I shows age-weight correlations for deer killed on some wildlife management areas during the 1968 and 1969 seasons.

Table II presents hunter success data for the more important wildlife management areas during the period. Herd production ratios are shown in Table III; acceptable averages are 150 fawns or more produced per 100 adult females.

Parasite and disease investigations were also

continued through Louisiana Wild Life and Fisheries Commission membership in the Southeastern Co-operative Wildlife Disease Study. Game biologists conducted additional investigations of common parasites and their infestation levels occurring in deer herds over the state.

A unique food habits study was continued during this biennium. Samples of rumen material were taken from deer killed at various seasons of the year and from all regions of the state. Examination by microscopic techniques will enable us to identify much of the plant material found in the samples and information gained will provide for a broader and more accurate knowledge of the dietary habits of the white-tailed deer. This will serve as a great contribution toward more efficient management of this game animal.

During this period a test study in telemetry or radio tracking of deer provided considerable insight into the controversial and poorly understood subject of normal seasonal and daily ranges of deer. Population dynamic studies probed still further the questions of pre and post season deer populations, percent harvested by hunters and other data long needed for a more reliable deer management program.

Habitat studies have included several important projects, the more notable of which involve tests in manipulation of natural ranges and the artificial establishment of food and cover plants for deer and other game. These projects include burning for stimulation of browse production; establishment of preferred browse species simultaneous with reforestation; winter plantings for deer; tests of sprout palatability, nutritive value and other effects of chemical treatments within commercial forests.

Another major management study involving deer is the annual deer kill mail survey conducted on a parish basis by the Data Processing Section. From the summary of estimates in the table it can be seen that both hunter participation and success increased considerably during the past two years.

As the major populations and, subsequently, the hunting of deer and other forest game shifts rapidly and undisputedly to the eight million acres of pine-hardwood hill lands, it is timely and appropriate that considerable research be expended on this region of the state. A multi-objective cooperative study in progress for several years between Louisiana Wild Life and Fisheries Commission, the U. S. Forest Service, and the Soil Conservation Service bears evidence to our agencies' awareness of these needs. Many of the aforementioned habitat study projects are likewise orientated to this need in conjunction with commercial forest management and other land uses which ultimately determine the trends that greatly affect forest game populations.

The purchase of over 100,000 acres of bottom-

land hardwoods by the Commission has brought with it a need to study an entirely new field, bottomland hardwood forestry orientated to maximum wildlife production. Initial projects extending through this biennium were complex multi-

objective projects on Russell Sage and Saline Wildlife Management Areas. These investigations deal with timber and understory management designed for development of more productive hardwood forests for wildlife purposes.

**Table 1**  
**COMPUTED LIVE WEIGHTS BY AGE CLASS OF DEER KILLED ON SOME LOUISIANA WILDLIFE MANAGEMENT AREAS DURING THE 1968 AND 1969 MANAGED HUNTS**

| <b>Alexander State Forest</b>   |             |                 |      |                |       |
|---------------------------------|-------------|-----------------|------|----------------|-------|
| <i>Sex</i>                      | <i>Year</i> | <i>AGE</i>      |      |                |       |
|                                 |             | <i>6 months</i> |      | <i>1½ year</i> |       |
| Male .....                      | 1968        | ( 4)            | 60.6 | ( 7)           | 98.0  |
| Male .....                      | 1969        | ( 3)            | 64.6 | ( 5)           | 105.6 |
| Female .....                    | 1968        | ( 1)            | 55.0 | ( 2)           | 77.7  |
| Female .....                    | 1969        | ( 2)            | 52.5 | ( 5)           | 79.0  |
| <b>Caldwell W.M.A.</b>          |             |                 |      |                |       |
| Male .....                      | 1968        | (37)            | 67.8 | (61)           | 117.3 |
| Male .....                      | 1969        | (34)            | 69.9 | (18)           | 131.0 |
| Female .....                    | 1968        | (33)            | 62.4 | (35)           | 97.3  |
| Female .....                    | 1969        | (54)            | 61.2 | (31)           | 104.0 |
| <b>Catahoula W.M.A.</b>         |             |                 |      |                |       |
| Male .....                      | 1968        | (30)            | 58.1 | (48)           | 100.7 |
| Male .....                      | 1969        | (28)            | 41.5 | (50)           | 87.2  |
| Female .....                    | 1968        | (23)            | 53.4 | (28)           | 80.3  |
| Female .....                    | 1969        | (22)            | 41.2 | (23)           | 72.7  |
| <b>Fort Polk W.M.A.</b>         |             |                 |      |                |       |
| Male .....                      | 1968        | (26)            | 56.5 | (25)           | 91.5  |
| Male .....                      | 1969        | (13)            | 56.5 | ( 7)           | 83.8  |
| Female .....                    | 1968        | (27)            | 56.4 | (18)           | 75.2  |
| Female .....                    | 1969        | (18)            | 50.1 | (14)           | 74.8  |
| <b>Georgia Pacific W.M.A.</b>   |             |                 |      |                |       |
| Male .....                      | 1968        | (58)            | 60.8 | (78)           | 103.1 |
| Male .....                      | 1969        | (83)            | 59.0 | (70)           | 105.5 |
| Female .....                    | 1968        | (48)            | 54.8 | (49)           | 88.6  |
| Female .....                    | 1969        | (76)            | 52.5 | (47)           | 87.4  |
| <b>Jackson-Bienville W.M.A.</b> |             |                 |      |                |       |
| Male .....                      | 1968        | (25)            | 55.1 | (22)           | 115.2 |
| Male .....                      | 1969        | (42)            | 64.2 | (53)           | 110.2 |
| Female .....                    | 1968        | (19)            | 51.5 | (18)           | 97.3  |
| Female .....                    | 1969        | (41)            | 46.8 | (33)           | 91.1  |
| <b>Red Dirt W.M.A.</b>          |             |                 |      |                |       |
| Male .....                      | 1968        | (32)            | 58.8 | (27)           | 100.5 |
| Male .....                      | 1969        | (18)            | 50.6 | (32)           | 95.8  |
| Female .....                    | 1968        | (40)            | 53.2 | (16)           | 84.6  |
| Female .....                    | 1969        | (18)            | 41.2 | ( 8)           | 74.2  |
| <b>Russell Sage W.M.A.</b>      |             |                 |      |                |       |
| Male .....                      | 1968        | ( 7)            | 69.1 | (15)           | 148.9 |
| Male .....                      | 1969        | ( 4)            | 52.6 | ( 3)           | 164.1 |
| Female .....                    | 1968        | (17)            | 64.4 | (12)           | 105.3 |
| Female .....                    | 1969        | ( 5)            | 63.2 | ( 2)           | 153.0 |
| <b>Saline W.M.A.</b>            |             |                 |      |                |       |
| Male .....                      | 1968        | ....            | .... | (29)           | 145.9 |
| Male .....                      | 1969        | ....            | .... | (49)           | 149.0 |
| Female .....                    | 1968        | ....            | .... | (Bucks Only)   |       |
| Female .....                    | 1969        | ....            | .... | (Bucks Only)   |       |

### Thistlethwaite W.M.A.

|              |      |      |      |      |       |      |       |
|--------------|------|------|------|------|-------|------|-------|
| Male .....   | 1968 | ( 7) | 54.9 | ( 8) | 140.3 | (11) | 229.9 |
| Male .....   | 1969 | ( 7) | 62.9 | (12) | 161.0 | (19) | 224.1 |
| Female ..... | 1968 | ( 5) | 61.0 | ( 3) | 129.6 | (11) | 123.2 |
| Female ..... | 1969 | ( 4) | 50.0 | ( 8) | 107.6 | (17) | 123.0 |

### Union W.M.A.

|              |      |      |      |      |       |      |       |
|--------------|------|------|------|------|-------|------|-------|
| Male .....   | 1968 | (10) | 66.9 | (13) | 115.1 | (12) | 150.3 |
| Male .....   | 1969 | ( 9) | 53.5 | (20) | 104.3 | (15) | 160.6 |
| Female ..... | 1968 | ( 8) | 62.5 | ( 8) | 85.4  | ( 6) | 102.5 |
| Female ..... | 1969 | (14) | 48.8 | ( 6) | 87.8  | (14) | 102.1 |

### West Bay W.M.A.

|              |      |      |      |      |      |       |       |
|--------------|------|------|------|------|------|-------|-------|
| Male .....   | 1968 | (97) | 52.9 | (86) | 84.7 | ( 70) | 116.5 |
| Male .....   | 1969 | (47) | 44.9 | (36) | 87.1 | ( 39) | 109.0 |
| Female ..... | 1968 | (74) | 48.6 | (59) | 77.1 | (115) | 81.3  |
| Female ..... | 1969 | (35) | 42.4 | (42) | 75.1 | ( 49) | 79.0  |

NOTE: Age-weight correlations were made only on those areas where sufficient data was collected.  
The number in parenthesis denotes size of the sample and the sum of these numbers does not necessarily represent the total number of deer killed.

Table 2

### HUNTER SUCCESS RATIOS FOR SOME LOUISIANA WILDLIFE MANAGEMENT AREAS DURING THE 1968 AND 1969 DEER HUNTING SEASONS

| Game Management Area             | 1968                        |                          |                            | 1969                        |                          |                            |
|----------------------------------|-----------------------------|--------------------------|----------------------------|-----------------------------|--------------------------|----------------------------|
|                                  | No. of<br>Hunter<br>Efforts | No. of<br>Deer<br>Killed | Hunter<br>Success<br>Ratio | No. of<br>Hunter<br>Efforts | No. of<br>Deer<br>Killed | Hunter<br>Success<br>Ratio |
| Alexander Forest .....           | 708                         | 25                       | 1/28                       | 363                         | 26                       | 1/14                       |
| Caldwell .....                   | 2,400                       | 354                      | 1/7                        | 1,965                       | 241                      | 1/8                        |
| Catahoula .....                  | 4,082                       | 219                      | 1/19                       | 3,788                       | 211                      | 1/18                       |
| Concordia* 1 .....               | 103                         | 1                        | 1/103                      | 107                         | 1                        | 1/107                      |
| Evangeline .....                 | 526                         | 9                        | 1/58                       | 212                         | 11                       | 1/19                       |
| Fort Polk** 1 .....              | 2,582                       | 157                      | 1/16                       | 2,858                       | 79                       | 1/36                       |
| Georgia-Pacific .....            | 6,251                       | 608                      | 1/10                       | 4,532                       | 470                      | 1/10                       |
| Jackson-Bienville .....          | 1,751                       | 136                      | 1/13                       | 3,498                       | 259                      | 1/14                       |
| Lutcher-Moore <sup>1</sup> ..... | 827                         | 28                       | 1/30                       | 622                         | 15                       | 1/41                       |
| Red Dirt .....                   | 3,845                       | 192                      | 1/20                       | 3,464                       | 136                      | 1/26                       |
| Red River* 1 .....               | 645                         | 16                       | 1/42                       | 479                         | 19                       | 1/25                       |
| Russell Sage .....               | 1,916                       | 71                       | 1/27                       | 1,102                       | 21                       | 1/52                       |
| Sabine .....                     | 439                         | 16                       | 1/27                       | 1,162                       | 57                       | 1/20                       |
| Saline* 1 .....                  | 2,870                       | 90                       | 1/32                       | 3,264                       | 65                       | 1/50                       |
| Thistlethwaite .....             | 1,598                       | 47                       | 1/34                       | 2,233                       | 67                       | 1/33                       |
| Union .....                      | 925                         | 57                       | 1/16                       | 1,600                       | 79                       | 1/20                       |
| West Bay .....                   | 9,300                       | 515                      | 1/18                       | 5,784                       | 264                      | 1/22                       |
| Zemurray** .....                 | 397                         | 24                       | 1/16                       | 295                         | 9                        | 1/33                       |
|                                  | 41,165                      | 2,565                    | 1/16                       | 37,328                      | 2,030                    | 1/18                       |

\* "Bucks Only" Hunting.  
\*\* Manner in which hunts were conducted does not reflect an accurate measure of hunter success.  
<sup>1</sup> Additional bucks only hunting allowed during other portions of the regular deer season; the resulting deer kill is not shown in this table.  
NOTE: All hunting is "any deer" hunting unless otherwise indicated.

Table 3

### DEER HERD REPRODUCTION RATIOS SHOWING NUMBER OF FAWNS PER 100 DOES OF AGE 2½ YEARS AND OLDER

| Wildlife Management Area | Adult<br>Does | Fawns | Ratios  |
|--------------------------|---------------|-------|---------|
| Caldwell W. M. A.        |               |       |         |
| 1968 .....               | 110           | 70    | 64/100  |
| 1969 .....               | 67            | 90    | 134/100 |
| Catahoula W. M. A.       |               |       |         |
| 1968 .....               | 116           | 106   | 91/100  |
| 1969 .....               | 53            | 50    | 94/100  |
| Fort Polk W. M. A.       |               |       |         |
| 1968 .....               | 35            | 53    | 151/100 |
| 1969 .....               | 23            | 31    | 135/100 |

#### Georgia-Pacific W. M. A.

|            |     |     |         |
|------------|-----|-----|---------|
| 1968 ..... | 116 | 106 | 91/100  |
| 1969 ..... | 152 | 159 | 105/100 |

#### Jackson-Bienville W. M. A.

|            |    |    |         |
|------------|----|----|---------|
| 1968 ..... | 37 | 44 | 119/100 |
| 1969 ..... | 67 | 83 | 124/100 |

#### Red Dirt W. M. A.

|            |    |    |         |
|------------|----|----|---------|
| 1968 ..... | 38 | 72 | 189/100 |
| 1969 ..... | 34 | 36 | 106/100 |

#### Thistlethwaite W. M. A.

|            |    |    |         |
|------------|----|----|---------|
| 1968 ..... | 11 | 12 | 109/100 |
| 1969 ..... | 17 | 11 | 65/100  |

#### West Bay W. M. A.

|            |     |     |         |
|------------|-----|-----|---------|
| 1968 ..... | 115 | 171 | 149/100 |
| 1969 ..... | 50  | 83  | 166/100 |

## DEER KILL MAIL SURVEY

### Statewide Summary of Estimates

|                   | 1967-68<br>Season | 1968-69<br>Season |
|-------------------|-------------------|-------------------|
| Hunters .....     | 124,047           | 139,704           |
| Days Hunted ..... | 1,019,731         | 1,210,192         |
| Deer Killed ..... | 35,830            | 50,031            |

### Parish Kill Estimates

| Parish                  | 1967-68<br>Season | 1968-69<br>Season |
|-------------------------|-------------------|-------------------|
| Acadia .....            | 0                 | 29                |
| Allen .....             | 1,019             | 797               |
| Ascension .....         | 77                | 78                |
| Assumption .....        | 227               | 517               |
| Avoyelles .....         | 398               | 668               |
| Beauregard .....        | 199               | 409               |
| Bienville .....         | 752               | 2,176             |
| Bossier .....           | 708               | 1,019             |
| Caddo .....             | 450               | 665               |
| Calcasieu .....         | 126               | 94                |
| Caldwell .....          | 1,158             | 1,792             |
| Cameron .....           | 17                | 134               |
| Catahoula .....         | 374               | 562               |
| Claiborne .....         | 453               | 837               |
| Concordia .....         | 1,760             | 2,265             |
| DeSoto .....            | 560               | 926               |
| E. Baton Rouge .....    | 17                | 152               |
| E. Carroll .....        | 1,307             | 1,958             |
| E. Feliciana .....      | 76                | 166               |
| Evangeline .....        | 199               | 173               |
| Franklin .....          | 149               | 498               |
| Grant .....             | 763               | 817               |
| Iberia .....            | 153               | 281               |
| Iberville .....         | 757               | 1,318             |
| Jackson .....           | 887               | 820               |
| Jefferson .....         | 61                | 56                |
| Jeff. Davis .....       | 61                | 105               |
| Lafayette .....         | 0                 | 0                 |
| Lafourche .....         | 194               | 262               |
| LaSalle .....           | 484               | 679               |
| Lincoln .....           | 398               | 577               |
| Livingston .....        | 156               | 486               |
| Madison .....           | 3,425             | 4,475             |
| Morehouse .....         | 1,429             | 2,534             |
| Natchitoches .....      | 801               | 981               |
| Orleans .....           | 0                 | 0                 |
| Ouachita .....          | 614               | 778               |
| Plaquemines .....       | 163               | 238               |
| Pt. Coupee .....        | 542               | 1,744             |
| Rapides .....           | 345               | 545               |
| Red River .....         | 389               | 470               |
| Richland .....          | 553               | 507               |
| Sabine .....            | 333               | 727               |
| St. Bernard .....       | 32                | 31                |
| St. Charles .....       | 94                | 145               |
| St. Helena .....        | 123               | 113               |
| St. James .....         | 128               | 206               |
| St. John .....          | 226               | 233               |
| St. Landry .....        | 274               | 362               |
| St. Martin .....        | 184               | 283               |
| St. Mary .....          | 175               | 284               |
| St. Tammany .....       | 273               | 557               |
| Tangipahoa .....        | 144               | 218               |
| Tensas .....            | 3,249             | 6,343             |
| Terrebonne .....        | 198               | 170               |
| Union .....             | 1,287             | 2,367             |
| Vermilion .....         | 258               | 415               |
| Vernon .....            | 708               | 906               |
| Washington .....        | 265               | 305               |
| Webster .....           | 268               | 717               |
| W. Baton Rouge .....    | 137               | 129               |
| W. Carroll .....        | 7                 | 45                |
| W. Feliciana .....      | 317               | 431               |
| Winn .....              | 397               | 1,613             |
| Unknown .....           | 2,656             | 1,575             |
| <b>TOTAL KILL .....</b> | <b>35,830</b>     | <b>50,031</b>     |

## WILD TURKEY TRANSPLANTING

### CLIFFORD WILLIAMS

During the 1968-69 biennium, Louisiana sportsmen participated in two of the longest wild turkey seasons in over 35 years. These seasons were for "gobblers only" hunting and were held in March and April each year. The annual kill was 250-300 birds and only five small areas of the state were open to this sport.

From an estimated original population of 1,000,000 birds, the number of wild turkeys in Louisiana dwindled to about 1,500 by the middle 1940's. Since the 1940's our state-wide population has increased by several thousand birds and several million acres of forest lands now provide suitable but uninhabited turkey range.

Management of this bird in the past has dealt with restrictions on season and daily bag limits, season lengths, closed seasons and attempts at restocking. Hunting seasons have been limited to spring gobbler seasons.



Biologist Harry Cook, securing biological data from gobbler killed on the Georgia-Pacific Wildlife Management Area.

Only the present restocking program by the Commission, in which wild trapped birds are used, shows any signs of being successful. The Louisiana Wild Life and Fisheries Commission initiated a wild turkey trapping and transplanting program in 1963. The main purpose behind the Commission's transplanting program is the expansion of wild turkey populations in order to provide additional outdoor recreation.

Since 1963, the Louisiana Wild Life and Fisheries Commission has secured a limited number of wild turkeys from the states of Alabama, Florida and Mississippi in addition to those from trapping efforts in parts of southeastern and northeastern Louisiana. Approximately 525 birds have been transplanted in 29 locations throughout the State. If this program continues to be successful, much of the potential wild turkey range over the state will be stocked within a few years. Then, the annual kill should be several thousand birds as compared to the few hundred which presently are being harvested each year.



Bird Bagged by E. S. Rushing, Monroe, during the 1969 Georgia Pacific Wildlife Management Area hunt.



Howard Sims, Bastrop, Louisiana, with gobbler bagged on Georgia Pacific Wildlife Management Area.



One of the successful kills on Georgia-Pacific during the 1969 controlled hunt.



Four adult gobblers before the common net trap during the winter of 1968-69. These birds are typical of those transplanted in many parts of Louisiana.

#### WILD TURKEYS TRANSPLANTED IN LOUISIANA—1963-69

| <i>Area</i>                   | <i>Parish</i>     | <i>Year</i> | <i>Gobbler</i> | <i>Hen</i> | <i>Total</i> |
|-------------------------------|-------------------|-------------|----------------|------------|--------------|
| Barksdale A.F.B. ....         | Bossier           | 1968        | ...            | 7          | 7            |
| Barksdale A.F.B. ....         | Bossier           | 1969        | 2              | 7          | 9            |
| Big Creek—Amite .....         | Tangipahoa        | 1966        | 2              | 8          | 10           |
| Big Creek—Amite .....         | Tangipahoa        | 1967        | 2              | 10         | 12           |
| Bodcau W.M.A. ....            | Bossier/Webster   | 1963/65     | 5              | 15         | 20           |
| Caldwell W.M.A. ....          | Caldwell          | 1965/66     | 8              | 9          | 17           |
| Caney (C.F.) W.M.A. ....      | Webster           | 1966/67     | 4              | 7          | 11           |
| Caney (M.F.) W.M.A. ....      | Claiborne         | 1967        | 4              | 17         | 21           |
| Caney (M.F.) W.M.A. ....      | Claiborne         | 1968        | 1              | ...        | 1            |
| Catahoula W.M.A. ....         | Grant/Winn        | 1965/66     | 10             | 11         | 21           |
| Cites Service W.M.A. ....     | Ouachita          | 1966/67     | 4              | 12         | 16           |
| Concordia W.M.A. ....         | Concordia         | 1965        | 3              | ...        | 3            |
| District VI .....             | Pointe Coupee     | 1965/66     | 20             | 10         | 30           |
| East Feliciana .....          | East Feliciana    | 1965        | 2              | ...        | 2            |
| Fort Polk W.M.A. ....         | Vernon            | 1965/66     | 9              | ...        | 9            |
| Fort Polk W.M.A. ....         | Vernon            | 1968        | 4              | 8          | 12           |
| Jackson/Bienville W.M.A. .... | Jackson/Bienville | 1965        | 8              | 15         | 23           |
| La. Ordnance Plant .....      | Webster           | 1969        | 2              | 10         | 12           |
| L. Silver Creek .....         | Washington        | 1967        | 3              | 4          | 7            |
| Look-out Point .....          | East Carroll      | 1966/67     | 12             | 19         | 31           |
| Lutcher Moore W.M.A. ....     | Vernon            | 1968        | 5              | 12         | 17           |
| Red Dirt W.M.A. ....          | Natchitoches      | 1967        | 6              | 12         | 18           |
| Red River W.M.A. ....         | Concordia         | 1967        | 5              | 14         | 19           |
| Red River W.M.A. ....         | Concordia         | 1969        | 4              | 15         | 19           |
| Russell Sage W.M.A. ....      | Ouachita          | 1963/65     | 9              | 11         | 20           |
| Sabine W.M.A. ....            | Sabine            | 1965/66     | 8              | 11         | 19           |
| Saline W.M.A. ....            | LaSalle           | 1965/66     | 17             | 24         | 41           |
| Saline W.M.A. ....            | LaSalle           | 1968        | ...            | 7          | 7            |
| St. Francisville .....        | W. Feliciana      | 1967        | 1              | 6          | 7            |
| St. Francisville .....        | W. Feliciana      | 1969        | ...            | 5          | 5            |
| Thistlethwaite W.M.A. ....    | St. Landry        | 1965        | 6              | 12         | 18           |
| Union Parish .....            | Union             | 1963        | 2              | ...        | 2            |
| Union W.M.A. ....             | Union             | 1968        | 1              | 5          | 6            |
| Union W.M.A. ....             | Union             | 1969        | ...            | 3          | 3            |
| Winter Quarters .....         | Tensas            | 1969        | 4              | 9          | 13           |
| West Bay W.M.A. ....          | Allen             | 1969        | 9              | 14         | 23           |
| Zemurray Park W.M.A. ....     | Tangipahoa        | 1965/66     | 4              | 10         | 14           |
|                               |                   |             | 186            | 339        | 525          |

## **SQUIRRELS**

**J. B. KIDD**

Successively good mast years in 1967 and 1968 raised squirrel populations to a better than average level for the 1968 season and to a bumper level for the 1969 season. Hunter success for 1969 has been estimated as the best since the last previous record crop was produced in 1962.

While no measure of total squirrel kill was made for the state during the two year period it is felt that the state-wide kill for each hunting season was considerably higher than during the 1967 season when the kill was estimated at 2,800,000.

In an effort to learn more about the effect of bag limits on squirrel kill the Commission set an experimental bag limit of 16 daily on the Thistlethwaite Wildlife Management area in St. Landry Parish for the 1968 and 1969 hunting seasons. This area of good squirrel habitat was selected because complete kill records have been maintained since the area was first opened to squirrel hunting in 1958 and the squirrel kill on this area is easily measured.

In 1968 a bag of 9,630 squirrels was made and during the 1969 season 5,580 were bagged. Despite the 1968 take of well over twice the average annual kill the 1969 kill was the third highest during the 14 years of hunting on the area.

An examination of the records from this research area reveal two important facts:

1. The squirrel population experiences drastic fluctuations which are related primarily to food supplies.

2. The squirrel kill varies from year to year principally paralleling the size of the fall population rather than variations in hunting regulations.

During two years of experimental 16 squirrel bag limit a total of 15,510 squirrels were harvested. Most of this kill was made by hunters who bagged 8 or less squirrels, in fact the total kill of squirrels in excess of 8 amounted to only 729 during the two seasons.

## **RABBITS**

**JACK COLLINS**

Since the liberal bag limits and long seasons now enjoyed by Louisiana rabbit hunters have no apparent effect upon the following hunting season population, the Commission's research efforts have been directed at measuring the effects of habitat changes on rabbit populations.

A twenty four acre study area on the Saline Wildlife Management area was selected to in-

vestigate the effects of logging on swamp rabbit habitat. The area was subdivided into 12 plots of 2 acres each. Four of these plots were thinned to one half the original volume of timber. On four, one-fourth of the timber was removed. The remaining four were not logged and serve as controls. Rabbitproof fences were built around the plots and they were each stocked with two pairs of adult swamp rabbits. The stocking was done during February of 1968. This stocking resulted in little survival or reproduction by October of 1968 when the pens were inventoried and cleaned for restocking. The second stocking, prior to the 1969 breeding season, resulted in some survival and reproduction. The inventory of the pens has not yet been completed.

## **BLACK BEAR**

**LOUIS BRUNET**

The black bear which once ranged over all of Louisiana had almost disappeared from most of its native haunts. Native bear range shrunk as a result of vast acreages of timbered areas being cleared for agricultural purposes. The remaining native habitat known to contain bear was an area in northeast Louisiana and in the lower Atchafalaya Basin. Occasionally a bear would be reported in other parts of the State. Habitat destruction and persecution by man are the two factors responsible for the low number of these animals.

The Wild Life and Fisheries Commission realized little could be done to renew bear habitat, but felt there was possibly a place for man and bear to co-exist on some of the remaining woodland areas of the state. In order to investigate this possibility, a bear restocking program was begun in 1964 and continued through the summer of 1967. The State of Minnesota offered bear to Louisiana if Commission personnel would trap them. The Minnesota black bear is the same species formerly abundant in Louisiana.

In the four summers the bear restocking program was carried on 156 animals were released. Of the 156 bear, 39 were released in Madison and Tensas Parishes with the remainder going to the Atchafalaya River Swamp, in Pointe Coupee Parish.

Of the total bear released, 35 have been verified as having been killed. These met death in various ways such as being hit by automobiles or killed by being shot.

In the release areas bear have been sighted and sign has been reported. There is also evidence of these bear reproducing.

The hunting season on bear has been closed since 1964.

**Land Owned or Leased by Louisiana Wild Life and Fisheries Commission for Public Use**  
**WILDLIFE MANAGEMENT AREAS MANAGED BY THE FISH AND GAME DIVISION**

| Name of Area           | Acreage | Location                              | Recreational Activities |           |       |       |          |       |      |       |         |         | Fishing    |           | Facilities Available |                    |              |
|------------------------|---------|---------------------------------------|-------------------------|-----------|-------|-------|----------|-------|------|-------|---------|---------|------------|-----------|----------------------|--------------------|--------------|
|                        |         |                                       | Hunting                 |           |       |       |          | Sport |      |       |         |         | Commercial |           |                      |                    |              |
|                        |         |                                       | Turkey                  | Waterfowl | Quail | Doves | Woodcock | Snipe | Bass | Bream | Croppie | Catfish | Buffalo    | Gaspergou |                      | Salt Water Species | Camping Area |
| Alexander State Forest | 7,875   | Rapides Parish                        |                         |           |       |       |          |       |      |       |         |         |            |           |                      |                    |              |
| Bodcau                 | 32,471  | Bossier-Webster Parishes              |                         |           |       |       |          |       |      |       |         |         |            |           |                      |                    |              |
| Bohemia                | 33,000  | Plaquemines Parish                    |                         |           |       |       |          |       |      |       |         |         |            |           |                      |                    |              |
| Biloxi                 | 39,728  | St. Bernard Parish                    |                         |           |       |       |          |       |      |       |         |         |            |           |                      |                    |              |
| Bonnet Carre           | 3,789   | St. Charles Parish                    |                         |           |       |       |          |       |      |       |         |         |            |           |                      |                    |              |
| Caldwell               | 12,123  | Caldwell Parish                       |                         |           |       |       |          |       |      |       |         |         |            |           |                      |                    |              |
| Caney                  | 34,000  | Webster-Claiborne Parishes            |                         |           |       |       |          |       |      |       |         |         |            |           |                      |                    |              |
| Catahoula              | 36,117  | Winn and Grant Parishes               |                         |           |       |       |          |       |      |       |         |         |            |           |                      |                    |              |
| Cities Service         | 16,400  | Onachita Parish                       |                         |           |       |       |          |       |      |       |         |         |            |           |                      |                    |              |
| Concordia              | 8,525   | Concordia Parish                      |                         |           |       |       |          |       |      |       |         |         |            |           |                      |                    |              |
| Evangeline             | 14,500  | Rapides Parish                        |                         |           |       |       |          |       |      |       |         |         |            |           |                      |                    |              |
| Fort Polk              | 114,000 | Vernon Parish                         |                         |           |       |       |          |       |      |       |         |         |            |           |                      |                    |              |
| Georgia Pacific        | 41,980  | Morehouse Parish                      |                         |           |       |       |          |       |      |       |         |         |            |           |                      |                    |              |
| Grassy Lake            | 11,800  | Avoyelles Parish                      |                         |           |       |       |          |       |      |       |         |         |            |           |                      |                    |              |
| Jackson-Bienville      | 22,000  | Jackson-Bienville Parishes            |                         |           |       |       |          |       |      |       |         |         |            |           |                      |                    |              |
| Lutcher Moore          | 54,269  | Vernon Parish                         |                         |           |       |       |          |       |      |       |         |         |            |           |                      |                    |              |
| Peason Ridge           | 33,000  | Vernon, Natchitoches, Sabine Parishes |                         |           |       |       |          |       |      |       |         |         |            |           |                      |                    |              |
| Red Dirt               | 38,500  | Natchitoches Parish                   |                         |           |       |       |          |       |      |       |         |         |            |           |                      |                    |              |
| Red River              | 16,977  | Concordia Parish                      |                         |           |       |       |          |       |      |       |         |         |            |           |                      |                    |              |
| Russell Sage           | 14,600  | Onachita Parish                       |                         |           |       |       |          |       |      |       |         |         |            |           |                      |                    |              |
| Sabine                 | 10,832  | Sabine Parish                         |                         |           |       |       |          |       |      |       |         |         |            |           |                      |                    |              |
| Sabine Island          | 8,700   | Calcasieu Parish                      |                         |           |       |       |          |       |      |       |         |         |            |           |                      |                    |              |
| Saline                 | 60,275  | Catahoula-LaSalle Parishes            |                         |           |       |       |          |       |      |       |         |         |            |           |                      |                    |              |
| Soda Lake              | 1,240   | Caddo Parish                          |                         |           |       |       |          |       |      |       |         |         |            |           |                      |                    |              |
| Spring Bayou           | 11,237  | Avoyelles Parish                      |                         |           |       |       |          |       |      |       |         |         |            |           |                      |                    |              |
| Thistlethwaite         | 11,200  | St. Landry Parish                     |                         |           |       |       |          |       |      |       |         |         |            |           |                      |                    |              |
| Union                  | 11,510  | Union Parish                          |                         |           |       |       |          |       |      |       |         |         |            |           |                      |                    |              |
| West Bay               | 57,575  | Allen Parish                          |                         |           |       |       |          |       |      |       |         |         |            |           |                      |                    |              |
| Wisner                 | 30,000  | Lafourche Parish                      |                         |           |       |       |          |       |      |       |         |         |            |           |                      |                    |              |
| Zemurray               | 5,000   | Tangipahoa Parish                     |                         |           |       |       |          |       |      |       |         |         |            |           |                      |                    |              |

## GAME MANAGEMENT AREAS

LOUIS BRUNET

The Fish and Game Division of the Louisiana Wild Life and Fisheries Commission manages a total of 30 Wildlife Management Areas. The acreage involved is 793,223 and is either owned or leased by the Commission. The topography and vegetative types vary from the marsh of southern Louisiana to the bottomland hardwoods of east central Louisiana to the pineland of the west and northwest part of the state.

These areas are managed as near as possible to the principles of good sound wildlife management. These areas furnish a tremendous amount of recreation in the form of hunting, fishing, boating, hiking, camping, and picnicking. Species hunted are squirrel, deer, rabbit, quail, dove, turkey, woodcock, waterfowl, rails, and snipe. Squirrel and deer are the most popular game on many of these areas.

In this time of valuable land being cleared for agricultural purposes most of the people who hunt these areas do not have another place to hunt. This means a lot to the people of the urban areas as it furnishes them with a place to hunt their favorite quarry.

Permits are required of hunters of licensing age to participate. For small game each hunter receives a season permit that entitles him to hunt any area open for a particular specie. Deer hunting is the only species where a tally is kept, on some areas, as to the number of hunters participating and their success. On those areas a daily permit is required. In 1969 this was done on 17 areas resulting in a total of 37,038 hunting efforts and 2,025 deer being taken. As a comparison in 1968, 41,165 hunting efforts resulted in 2,565 deer being harvested. On other areas a great number of hunters participated but the actual deer kill is unknown.

The deer seasons on most of the areas are for either sex. The taking of any deer will be allowed on the other areas when the population nears the carrying capacity of the range. The taking of either sex deer is the best management tool to keep the deer herd in balance with the food supply on the range.

Those areas having suitable turkey habitat have been stocked and the populations are building up. For a few years some of these birds will be trapped and used to restock suitable habitat statewide. These fine birds, whether on or off the Wildlife Management Areas will furnish additional recreation opportunity for the hunter.

Each year the hunting seasons on the Wildlife Management Areas are very successful and the participating hunters enjoy them.

The accompanying chart covers each area by acreage, location, recreational activities and facilities available.



At sport shows, instructors in the education section tell the story of "Louisiana—Sportsman's Paradise."

## Education Section

ALVIN M. CARVER  
Supervisor

The key to the success of the Conservation Program of the Louisiana Wild Life and Fisheries Commission is determined by the acceptance, support and cooperation of the citizens of our state. The Education Section has the responsibility of keeping Louisianians informed and abreast of fish and game management practices, wildlife laws, pollution control, in addition to the many other Commission activities.

This section has seven instructors that presently are averaging 175 programs per month, with an average monthly attendance of 5,775 students. Programs are presented to both grammar, high school and college students, as well as



A visual, life-like display, such as this fur products exhibit, gives groups a good idea of what economic values Louisiana has to boast about.

scout troops, 4-H clubs, church organizations, garden clubs, civic clubs, sportsmen's clubs, and any other non-profit organizations where the story of our wildlife resources may be told. During this biennium five accredited teacher workshops on wildlife conservation were conducted in cooperation with the State Department of Education throughout the state. Radio and television programs are frequently presented over the state on various aspects of the conservation activities.

The Education Section operates a film and publication library located at Baton Rouge, which plays an important role in keeping our citizens informed. Through the library 8,857 requests for information on wildlife were handled and 2,556 wildlife films were loaned to interested groups. The library has 104 different booklets on wildlife, published by the Commission and approximately 90 different color and sound 16 mm films



Youngsters learn what species of fish that Louisiana's streams hold.



The story of Louisiana's abundant wildlife resources can be told vividly in a life-like display.

which are available on request by teachers and civic organizations of Louisiana. The films are loaned on written request and without charge, except for return postage. Request for information, booklets, or films should be directed to Film Library, P. O. Box 44095, Capitol Station, Baton Rouge, Louisiana 70804.

Wildlife displays showing the aesthetic, recreational, economical and social values of our wildlife resources have been a popular phase of our work. Some 40 wildlife scenes were erected at fairs, festivals, conventions and shows throughout the state. In cooperation with the Louisiana Tourist Commission, several out-of-state travel shows were attended by our personnel informing citizens of other states of our sportsmen's paradise.

Requests for programs or displays should be directed to Louisiana Wild Life and Fisheries Commissions at Monroe, Lake Charles, Minden, Baton Rouge, New Orleans, Alexandria, and Opelousas, Louisiana.

## Louisiana Firearms and Hunter Safety Program

**BEN R. BROWN**

Hunter Safety Coordinator

Louisiana's hunters have had the opportunity to participate in a program of Hunter Safety Training since 1968 under the auspices of the Louisiana Firearms and Hunter Safety Program. Both experienced and inexperienced hunters can benefit from the training, with emphasis being placed on the latter. None of the people involved in hunting accidents in 1968 and 1969 had been exposed to Hunter Safety Training.

Approximately three hundred instructors have been trained since the program has been underway. These people have trained over two thousand pupils in safe hunting practices.



A hunter safety instructor teaches a little hunter the proper shooting positions, such as lying flat on the ground. Other proper shooting positions are standing, sitting, kneeling and off-hand.



Three hundred trained instructors have taught safe hunting practices to more than 2,000 pupils of all ages.

(Photos shown clockwise from above)

Instructor readies students for actual firing on the range which drives home impressions learned from lectures and demonstrations in the classroom.

Guns are passed from hand to hand across a "fence" to avoid accidental misfiring.

Hunters of all ages, experienced and inexperienced, enroll in the commission's hunter safety courses.

Using rope as a mock fence, the instructor holds "barbed wire" while his student crosses over.

Getting in and out of a boat can be doubly difficult when carrying a gun. Extra caution must be exercised when holding a gun or passing it to a person in a boat.



# Oysters, Water Bottoms And Seafoods Division



TED B. FORD  
Chief

**T**HE DIVISION was extremely active and participated in several areas of scientific work during the past two years. Such staff participation is a significant accomplishment in the marine fisheries field.

Personnel of the division have conferred with scientists from other states and countries both in the office and at the Marine Laboratory about the marine research program. There has been a tremendous interest in pond culture studies of shrimp, and the work completed in Louisiana represents good leadership in this field.

In January, 1969, the division organized and held the first Mariculture Conference for the Gulf area at the Marine Laboratory. This was in cooperation and in response to action of the Estuarine Technical Coordinating Committee of the Gulf States Marine Fisheries Commission at the October, 1968, regular meeting. Additionally, the division hosted the first Federal Aid Coordinators' Conference for the Gulf states participating in the Public Law 88-309, Commercial Fisheries Research and Development Program. Both of these meetings were of a workshop type and quite successful.

Louisiana's participation in the P. L. 88-309 program resulted in a coastwide expansion of marine research and the collection and evaluation of data concerning the fisheries, hydrography and sedimentology of this area. Field work was completed on the cooperative estuarine inventory and study. This project, no doubt, contributes a first in that it was a cooperative effort between several of the Gulf states and the Bureau of Commercial Fisheries whereby there were standardized sampling and evaluation procedures. Already the demand for the use of the data before it can even be published has been almost overwhelming and has created some problems in trying to cooperate with other interested agencies. The ultimate objective of this project is to publish the

data in atlas form, making it available to the scientific community as useful yardsticks for the future management of Louisiana's marine resources.

Concurrently, two cooperative films were completed for the five Gulf states and the Bureau of Commercial Fisheries. These films, "Estuarine Heritage" and "The Biologist and the Boy," should help focus attention on the valuable estuarine or nursery areas which exist in this country and especially in the Gulf. The films were produced to stimulate a strong interest for the preservation and wise use of these valuable areas.

Following the completion of the field work for the estuarine inventory and study, several new research projects were initiated. These projects deal with more specific work on shrimp, crabs, oysters, menhaden and industrial fishes. Additionally, an artificial oyster tonging reef project was installed and will be evaluated to determine the feasibility of this as a good management practice in some areas having limited guidelines. Thus, the research program is generally oriented from the extensive type of projects through a step-wise procedure to the more intensive type of projects which will have a direct bearing on the future management of the marine fisheries of Louisiana.

The pond culture studies on shrimp, initiated in 1962, were continued and expanded. Having 16 additional one-quarter acre ponds enabled us to expand and replicate these studies. The interest in this program has been widespread and many from other parts of the country and the world have visited the Marine Laboratory on Grand Terre Island to inspect our facilities and

discuss this research program. One of the problems in pond culture studies is that of having a sufficient stock of animals with which to work. Accordingly, a shrimp spawning project was initiated to provide a timely source of supply of shrimp when needed for the research program and also to define the shrimp spawning procedure which will be useful in Louisiana. Although this work has been satisfactorily performed at a few other locations around the Gulf, this project will be useful to the Commission and others in Louisiana when the rearing of shrimp in ponds becomes economically feasible in the next few years—possibly one to ten.

A two-year project on the basic plankton productivity and other basic nutritional sources was completed in December, 1969. This program should provide a good insight for the interpretation and evaluation of the highly productive estuarine waters of Louisiana. The substantial need remains to correlate this work with other studies in determining the total fisheries productivity of the Barataria Bay system. This may be done in the next two years.

Recently, the division has cooperated with the Louisiana State University sea grant studies program by assisting with the design of their general program and, more particularly, by providing space for a study of the effects of oil pollution on shrimp. A continuing effort is being made toward this end by providing data for prototype environmental studies. Their concept is unique and represents a dynamic approach in shrimp biology. This project will be followed with much interest.

Personnel and floating equipment of this division were used cooperatively with the State Department of Health in assisting with the examination of oyster growing waters and with the U. S. Shellfish Research Center of Dauphin Island, Alabama, in the monitoring for heavy metals in coastal waters.

Technical personnel of the division have participated in two major studies with the Corps of Engineers having prime responsibility, the Bureau of Commercial Fisheries, the Bureau of Sport Fisheries and Wildlife, and several other state and federal agencies. These are the Coastal Louisiana Study and the Mississippi River Water Transport Study. The implications of these two studies are of substantial magnitude with possible far-reaching effects on the marine fisheries of Louisiana, in particular, and virtually all other fish and wildlife resources. Therefore, it is necessary to effect the best input of data and talent in order to safeguard the valuable fish and wildlife resources of coastal Louisiana. It should be emphasized that this participation is being accomplished without having suitable funds or personnel to utilize in an effort of this magnitude. Therefore, existing programs must be compromised in order to participate.

Hurricane Camille hit the Louisiana and Mississippi Coast on August 17, 1969. Damages to the oyster seed grounds were extensive, being estimated at about 50 percent to the total seed ground area east of the Mississippi River. A grant was obtained under the provisions of Public Law 88-309 to assist in the recovery of a natural disaster. The grant in the amount of \$176,388 enabled the division to make an initial fall planting of 30,000 cubic yards of clam shell, half in the Snake Island area of Black Bay and the other half in the sound side of Three Mile Pass. The shell planting program will be completed in the spring of 1970. These plantings should provide supplemental seed oysters to assist in the recovery of the natural seed ground area and be instrumental in helping the oyster industry.

A significant accomplishment was the finalization of a joint agreement between the Commission with legislative authorization and the Plaquemines Parish Commission Council in December, 1969, both equally representing local interest on a cost sharing basis, with the U. S. Corps of Engineers. This local interest agreement will provide for the implementation and construction of a major freshwater introductory structure in the vicinity of Nestor Canal in the Bohemia Spillway area on the east bank of the Mississippi River. Those concerned with the oyster industry have recognized for a number of years the value of and need for fresh water from the Mississippi River to depress salt water intrusion and provide a favorable environment for the setting of oyster spat. This project should help substantially this area of the natural seed grounds. This segment of the overall project was formerly recommended to the Corps of Engineers in the spring of 1955. Hopefully, this structure will be installed and operating before 20 years has passed.

Strong consideration has been given to the future program of this division and its prospective service to the marine fisheries industry which it serves. A site was purchased for the Houma Area Field Station. Then, with the cooperation of the Department of Public Works, plans and specifications were prepared and the contract was let for the construction of a suitable field station. This will provide office space, laboratory space and storage facilities for the two study groups working in that area between Bayou Lafourche on the east and the Atchafalaya River on the west.

The Department of Public Works has completed plans and specifications for additional dormitory housing and outdoor shrimp research tanks at the Marine Laboratory. The contract is expected to be let early in 1970. Additionally, the Department of Public Works completed plans and specifications for the replacement of the Sister Lake Camp boat house and the improvement of

its slip as well as the bulkheading of an eroding section around the camp. This work should complement that previously performed at that location and will provide a base of operations for the field work in the western marshes of Terrebonne Parish.

The eye of Hurricane Camille virtually passed over the Grand Pass Camp located in the easternmost marshes of Louisiana. An inspection of the remains of this facility indicates that tornadic winds probably destroyed the camp. The sill elevation of this high-rise camp was approximately 18 feet above mean sea level to permit storm tides to pass beneath it. Plans were initiated for the replacement of this camp by securing the services of an architectural firm. The Department of Public Works could not give assistance within the required time interval in order for the Commission to recover some losses from the U. S. Office of Emergency Planning. This facility is to be replaced by August 17, 1970.

Continuing evaluations of future needs during the past few years have emphasized the fact that additional marshland will be required in the vicinity of the Marine Laboratory in order to continue and expand the excellent marine research and field testing programs, presently restricted by spatial limitations. Efforts have been initiated for the acquisition of additional marshland which should meet all prospective future needs.

Good progress was made in improving the quality of the surveys of oyster leases and in the number of leases which were handled. The Oyster Lease Monument Control program has clearly demonstrated the value of having good markers by which these valuable oyster producing water bottoms can be surveyed. This is a continuing program which may require several additional years in order to complete the establishment of markers in all of the more congested oyster lease areas.

Coastal Waste Control Sectional activities, temporarily transferred by administrative action to the Water Pollution Control Division during a greater portion of this biennium, were continued as a service to the oyster industry and for the general well being of the coastal marshes. The limitation of personnel in this program has been a serious factor in achieving desirable levels of control. The current trend of the public attitude toward pollution in general strongly suggests that there will be demands for a more expanded program which would then permit us to exercise a much more efficient level of control. It appears that the guidelines of the "70's" will be to absolutely eliminate any type of pollution or contamination from industry and the public at large due to negligence, and the rapid cleanup by responsible parties of any accidental pollution. Industry and the public are urged to cooperate with this Commission and other state and federal agencies

in order to achieve dramatic improvements in our coastal environment for the benefit of our present and future citizens.

These highlights of this two-year program reflect material accomplishments and suggest future pathways which represent the best available approaches and interests in behalf of the citizens of Louisiana.

Good responsibility is being achieved among those having the ability to recognize such gains. However, the most crucial and critical factor is the need for competency and the availability of funds with which to carry out these programs. In addition to the fabulous renewable and non-renewable natural resources of Louisiana, perhaps the greatest resource is that segment of Commission employees diligently working to provide good stewardship for the use of these resources. Efforts are continually being made to seek excellence and good foundations are being laid to accomplish this. Indeed, qualified loyal competent personnel is a blessing to Louisiana which should be recognized. A number of personnel are achieving at or above their basic capability levels, who are extremely proud and rightfully so of their work, all in behalf of trying to contribute to a better Louisiana.

## **EFFECTS OF HURRICANE CAMILLE ON LOUISIANA'S OYSTER GROWING AREAS EAST OF MISSISSIPPI RIVER—LAKE BORGNE TO CALIFORNIA BAY AND OTHER MARINE FISHERIES INDUSTRIES**

**by TED B. FORD**

Hurricane Camille passed close to the mouth of the Mississippi River and along the eastern Louisiana marshes before hitting the mainland in the vicinity of Pass Christian, Mississippi, on August 17-18, 1969. Although this course missed most of the land based facilities and the fishing fleet, substantial damages and numerous total losses were experienced in lower Plaquemines Parish and upper St. Bernard Parish.

The oystering grounds in St. Bernard Parish above the Mississippi River-Gulf Outlet Seaway appear to have experienced substantial damages at the 30-40 percent level. Approximately 80 percent of Louisiana's oyster production between the Mississippi and Atchafalaya rivers is dependent upon seed oysters obtained east of the Mississippi River; therefore, the oyster industry may experience a serious setback.

An assessment of the effects of Camille's damages can be summarized in these categories: 1969-70 and future oyster seasons; Other fisheries; Camps, boats and equipment of oyster and other fishermen; Fisheries handling facilities and homes; and Related problems. Each of the above

items is discussed in relation to the short term and long term effects. One should keep in mind that Hurricane Betsy in 1965 wrought considerable devastation on part of this same area less than four years ago. Total recovery was not yet completed when Camille struck.

#### EFFECTS ON 1969-70 AND FUTURE OYSTER SEASONS

Oyster culture in Louisiana is essentially a farming operation and helps account for present and future oyster production. Generally, seed oysters are removed by dredging from the state managed seed ground east of the Mississippi River then transported to private leases on both sides of the river where the seed oysters are planted, cultivated and fattened before marketing. This practice is employed on an annual basis beginning September 1, when the season opens, and being completed by May, but there are exceptions. Some private growers produce their own seed and some beds are in continuous production but on a rotational basis. Hence, some oysters planted in 1969 may not be marketed until 1971.

The state managed seed grounds lying east of the Mississippi River encompass approximately 450,000 acres. Salt water intrusion, steadily increasing over the past twenty years and accelerated by the Mississippi River-Gulf Outlet, has reduced the effectiveness of this area by some 60-65 percent. Therefore, the state and the oyster industry is greatly concerned about the productivity of the remaining area. On this same side of the river there are 332 oyster bottom lessees holding 48,450 acres which is approximately 35-40 percent of the total leased acreage. Damages to this area east of the river could have a pronounced effect on the 1969-70 season.

During September 4-8, 1969, personnel of the Oysters, Water Bottoms and Seafoods Division determined the relative extent of damages to the oyster seed ground areas and randomly selected private leases.

The survey showed that generally, oyster growing areas and leases lying north of the Mississippi River-Gulf Outlet were subjected to varying amounts of mud, silt and marsh grass damage. In some instances siltation varied from four to twelve inches and in other cases it was less or



none at all. Substantial amounts of marsh grass were found overlying oysters in a number of areas north of the Mississippi River-Gulf Outlet. The number of recently dead oysters ranged from few to 95 percent. On some leases believed to have oysters, none or very few were found which suggested that these oysters had been washed off of the lease and covered. At another location where several boat loads of oysters were known to be planted, the oysters and the bottom on part of the lease were clean and in good condition, while the other part of the lease had a considerable amount of soft mud and marsh grass with many recently dead oysters.

Observations of marsh conditions showed that a substantial amount of mud and marsh grass was relocated or eroded away. Some of the more prominent locations included the entrance to Nine Mile Bayou, a point on Indian Mound Bay, a point off Deep Water Pass, Brush Island and Door Point.

A considerable number of recently set oyster spat were observed generally throughout the area north of the Mississippi River-Gulf Outlet. These oyster spat had set chiefly on oyster shell with relatively few having set at that time on live oysters. Categorically, no firm conclusion can be drawn that all oyster leases and seed ground reefs escaped damage because the extent of overlying marsh grasses and mud varied considerably. The effect of this overburden on the oysters having little to severe damage may depend on how quickly the oyster fishermen are able to work the natural reefs and private leases. Prompt dredging of these areas would tend to remove much of the matter and reduce the number of oysters dying as a result of overburden.

An area lying south of the Mississippi River-Gulf Outlet Channel to Bayou Terre Aux Bouefs appears to have relatively little damage in comparison with the area above the seaway. The extent of grass coverage and soft mud was quite limited. On the other hand, leases in or below Bayou Terre Aux Bouefs lying chiefly in the marsh west of the larger lakes and bays were found to have rather heavy coverage of marsh grasses. Soft mud bottoms were found on parts of some. Few recently dead oysters were observed; however, the loss of oysters can be expected on those leases unless the heavy marsh grass overburden is promptly removed. The area south of Bay LaFourche and Black Bay appears to be less damaged than other areas described above. Some mud and grass was found overlying oysters, but not as heavy as previously observed.

In the Bay Gardene Oyster Seed Ground Reservation, some areas had a considerable amount of soft mud and old marsh grass (peat-like in appearance) over hard reef. This suggested the settling of large parts of eroded marsh over the bottoms as the waters receded. In another area there was little grass and virtually no mud pres-

ent; the oysters were clean with very few recently dead. Perhaps, this best typifies the intermittent and random damage that can be experienced in oyster growing areas. This type of scattered damage greatly reduces fishing efficiency.

In personal interviews with captains of oyster boats, one captain stated that he was able to fish good seed oysters efficiently at his fishing site and had done so for several days. He said that he did not know what he would run into in other locations which appeared to be good in late July and early August when he checked where he would fish when the seed grounds opened on September 1. In contrast, several other fishermen stated that the abundance of oysters checked after the storm was considerably less than they had estimated in inspecting several areas for seed and sack oysters prior to the storm. Other fishermen stated that the catches of sack oysters in the lower natural reef areas were running considerably less than last year. One stated that he was running into marsh grass mostly with virtually no silt.

On the basis of the examination, it appears evident that a number of the natural reefs and private leases were damaged substantially by the storm. Some leases in the area affected by the storm appeared to have little or no damage. The vast majority of the damage experienced was north of the Mississippi River-Gulf Outlet Channel. Too many leases were involved and subject to damage to consider making more than a random sampling of this overall area.

## EFFECTS ON OTHER FISHERIES

Reports received after the storm show that at least a residual segment of a very promising white shrimp crop is available on the grounds. Indications prior to Camille were that this year's crop east of the Mississippi River would be better than those of the past several years. The total effect on post-larval and early juvenile shrimp on the nursery grounds is unclear, although these groups appear to experience considerable losses when exposed to severe hurricanes. Catches of sub-adult shrimp since the storm appear to be good in size count and numbers. Debris deposited by the storm in much of the traditional fishing waters has reduced the overall efficiency. This potential set-back should not affect next year's production and recovery is expected.

Several localized fish kills were reported in the aftermath of the storm. Of these, some were due to fish remaining in areas between levees, subsequently dewatered. Others appear to be due to excessive organic decomposition of wind blown leaves and other plant materials. Reports from some of the affected areas suggest the presence of larger numbers of redfish (channel bass) than prior to the storm. Since fish are mobile, many no doubt avoided getting stranded. These losses appear negligible in respect to the total population.

No observations or reports of blue crab kills were made. The biggest problem here was the damage or loss of gear which could not be retrieved prior to the storm.

#### EFFECTS ON CAMPS, BOATS AND EQUIPMENT OF OYSTER AND OTHER FISHERMEN

Only one of a number of private oyster camps dispersed throughout the marsh in the oystering area above the Mississippi River-Gulf Outlet remained intact. Most of the camps were completely destroyed—a few pilings stand as mute evidence of a previous existence as a base of operations.

The Louisiana Wild Life and Fisheries Commission lost two major camp facilities, one at the mouth of the river at Pass a Loutre and the other in extreme northeastern marshes at Grand Pass. A third camp was lost at the southeast corner of Lake Borgne. The Bay Gardene Camp, located about eleven miles east of Point a la Hache, was damaged moderately. A boat house and shore facility at Bayou Caddy, Lakeshore, Mississippi, used to service the Grand Pass Camp, was severely damaged. The Commission's wharf and base radio station off Lake Pontchartrain in New Orleans experienced damage from high water.

A number of fishing boats in the area from Buras to Venice were washed ashore which required substantial assistance to refloat them. Others were severely damaged or lost entirely, according to aerial observations and reports from some fishermen. A number of fishermen lost new or rehabilitated equipment and fishing gear since they were ready for the fall shrimp season and the September 15 oyster season.

Some crab and food fish fishermen were reported to have lost much of their equipment and gear. In certain areas crab pots were observed washed upon the marsh and crumpled. A number of small boats and skiffs used in these fisheries were lost or damaged.

#### FISHERIES HANDLING FACILITIES AND HOMES

Any successful fishery must have supporting handling facilities. The fish sheds and coolers located between Buras and Venice were hit hard, experiencing severe damage or total devastation. Two fish meal plants at Empire had damaged oil and fish soluble tanks and damaged plant processing equipment and service facilities. Some processed fish meal was damaged by flood waters and had to be destroyed. The fleets weathered the hurricane with little or no damage, being ready to fish again as soon as the menhaden could be handled. Emergency repairs were expected to be completed in three weeks to take advantage of the remaining six to eight weeks of fishing.

Virtually no homes were spared in this same area of Buras to Venice, there being total devastation or substantial damage. From Buras to

Port Sulphur, many homes experienced water damage in addition to wind damage.

Damages to homes east of the river in Plaquemines and St. Bernard parishes were not as extensive. Handling facilities here were temporarily out of service, but rapid recovery was imminent.

A number of small commercial fisheries and allied operations in eastern Orleans and lower St. Tammany parishes bordering Lake Borgne, Lake Pontchartrain and vicinity including the Chef Menteur and Rigolets areas were damaged materially or were total losses. Relatively minor damages were experienced by one oyster factory in this area largely because it was not located on open water.

#### RELATED PROBLEMS

A major hurricane, such as Camille, has a detrimental effect on virtually everything within its range, especially in low lying, highly productive estuarine areas as found along the Mississippi River Delta complex. In addition to the bountiful fish and wildlife habitat, this area is also characterized by its oil, gas and sulphur resources. Numerous powerfully constructed oil and gas producing units and support facilities, including tank batteries, separators, storage terminals, refineries, suffered costly damages and losses. The major oil losses were confined within levees. Hopefully, this dispersion and clean-up did not materially affect oyster growing waters. Other losses from tank batteries and broken pipe-lines appeared to be comparatively minor. Most of the affected operating companies initiated repairs as promptly as possible. There has been no recognized pollution of oyster areas, and health officials have not advised the commission of any. Steps were taken through the Corps of Engineers and local officials to have oil confined between levees cleaned properly.

The debris such as lumber, appliances, grass mats, and mud lumps constitutes a serious problem for fishermen trawling and dredging on the water bottoms. In addition to curtailing fishing efficiency, this debris can damage boats and fishing gear. Much of the sunken debris cannot be avoided.

#### CONCLUSIONS

A number of people associated with the fishing industry suffered substantial damages and losses: (1) Physical losses to their boats, camps, equipment, gear, oyster leases, the oyster seed grounds upon which they were dependent; and (2) Personal losses of their homes and possessions. Many of these people will have to seek assistance to recover from the effects of this tremendous natural disaster. Although most have the determination

and are trying to help themselves, they must rely on realistic programs of assistance designed and geared to the particular kind of fishery where most of their lifetimes have been spent. The commission urges the favorable consideration and implementation of such programs. Additionally, the commission stands ready to assist the primary agencies to expedite their recovery.

In conclusion, the most effective way for the Louisiana Wild Life and Fisheries Commission to assist in the recovery of the fisheries industry is to initiate a large-scale shell planting program on the state managed oyster seed grounds to provide cultch for oyster spat. Federal disaster assistance has been sought through P. L. 88-309, Section 4(b), The Commercial Fisheries Research and Development Act. The commission's recommendation is to make an initial planting in the immediate future, hopefully to secure a fall set of oyster spat. These may be useful under favorable conditions as seed oysters in the fall of 1970. Additional planting of shell would be made next spring when there is normally a heavy spat fall. Seed oysters caught in the spring of 1970 would not be available to the fishermen until September, 1971. Unlike the oyster, which is sessile after it sets, other fisheries (such as, shrimp, crabs, fin fishes) are free-swimming. Accordingly, all factors being reasonable, short-term recoveries can be expected next season.

#### Statistics

|                                    | 1967        | 1968        |
|------------------------------------|-------------|-------------|
|                                    | (lbs)       |             |
| Shrimp production (heads on) ..... | 75,317,000  | 67,768,000  |
| Freshwater fish production .....   | 8,198,000   | 9,880,000   |
| Saltwater fish production .....    | 6,490,000   | 35,834,000* |
| Baby green turtles .....           | 1,800       | 900         |
| Menhaden production .....          | 510,414,000 | 622,291,000 |
| *(includes unclassified fish)      |             |             |

#### Report of Collections (fiscal year)

|                                     | 1967-68 | 1968-69 |
|-------------------------------------|---------|---------|
| Oyster bedding ground rentals ...\$ | 118,987 | 112,438 |
| privilege tax .....                 | 12,338  | 12,444  |
| tonnage licenses .....              | 1,329   | 1,837   |
| dredging licenses .....             | 4,900   | 9,310   |
| resale, shop, etc. ....             | 1,580   | 1,835   |
| Transfer fees .....                 | 57      | 41      |
| Shells—oyster .....                 | 620,856 | 771,313 |
| clam .....                          | 538,616 | 577,725 |
| Gravel .....                        |         |         |
| Sand .....                          | 4,751   | 631     |
| Fill material .....                 | 150,156 | 181,805 |
| Survey fee .....                    | 15,036  | 26,405  |

#### Report of Production (calendar year)

Total barrels of oysters  
taken from Louisiana waters

|                   | 1968       | 1969       |
|-------------------|------------|------------|
| Terrebonne .....  | 82,723.50  | 44,374.50  |
| Lafourche .....   | 14,285.50  | 35,222.50  |
| Plaquemines ..... | 120,327.00 | 64,822.00  |
| Jefferson .....   | 58,493.00  | 57,988.50  |
| St. Bernard ..... | 172,286.00 | 157,241.00 |

Total cubic yards of sand, shells, gravel and  
fill material taken from Louisiana waters

|                     | 1968         | 1969          |
|---------------------|--------------|---------------|
| Sand .....          | 48,282.99    |               |
| Oyster shells ..... | 5,341,488.35 | 5,870,417.27  |
| Clam shells .....   | 5,123,311.62 | 4,510,865.88  |
| Gravel .....        |              |               |
| Fill material ..... | 3,237,269.48 | 14,532,904.20 |



Grand Pass Camp after Hurricane Camille.

### OYSTER SEED RESERVATION CAMPS

#### GRAND PASS CAMP

(Port of Entry)

Hurricane Camille, on August 17 and 18, 1969, completely destroyed the Grand Pass Camp and Port of Entry located south of Cat Island Channel in the northeast corner of the Louisiana marshes. This camp served as clearing station for out-of-state fishing vessels working under permits in Louisiana waters. This facility also provided a headquarters for Commission field personnel performing survey, enforcement, research and management activities related to marine resources in this general area. Until this camp can be replaced, a quarterboat will be used to provide facilities needed to maintain a station to inspect catches and authenticate required out-of-state fishing permits.

#### BAY GARDENE CAMP

The Bay Gardene Camp located in the marshes 11 miles east of Pointe-a-la-Hache sustained some wind damage to the roof, screens, wharf and bathhouse. Although relatively minor, these damages required considerable time and effort to repair. This camp acts as a headquarters for personnel assigned to the patrol and enforcement of commercial fishing regulations in this general area. It also provides surveillance of the Bay Gardene natural oyster seed reservation and the Black Bay managed oyster seed grounds.



Grand Pass Camp before Hurricane Camille.

#### SISTER LAKE CAMP

The Sister Lake Camp was undamaged by the storm and during the past four months electricity has been provided to this area and the camp facility was rewired. Additional remodeling expanded the dining and living quarters to provide improved accommodations for the assigned personnel. This camp serves as a field headquarters for Commission personnel doing marine research in the general area. It also allows for patrol of the Sister Lake and Bay Junop natural oyster seed reservation and grounds.

#### BILOXI OFFICE

The Biloxi Office was also lost during Camille. This facility was established to allow out-of-state fishermen the convenience of securing permits to fish Louisiana waters. This area is central for a large fishing industry in Mississippi and Alabama. By having an office in this area, it permits a better dockside check of catches and landings and a conformation of records so that appropriate severance taxes are collected. Another office has been temporarily set up to assist the fishermen in this area.



Sister Lake oyster-seed reservation camp.

## MONUMENT CONTROL PROJECT

This program was made possible under the Commercial Fisheries Research and Development Act, Public Law 88-309, and is aimed at providing exact geographical control for the surveying of new and existing areas leased for the production of oysters. With the establishment of these strategically located monuments (markers), exact surveys detailing location, size and configuration of individual oyster leases, along with accurate descriptions of each area can be maintained for permanent records.

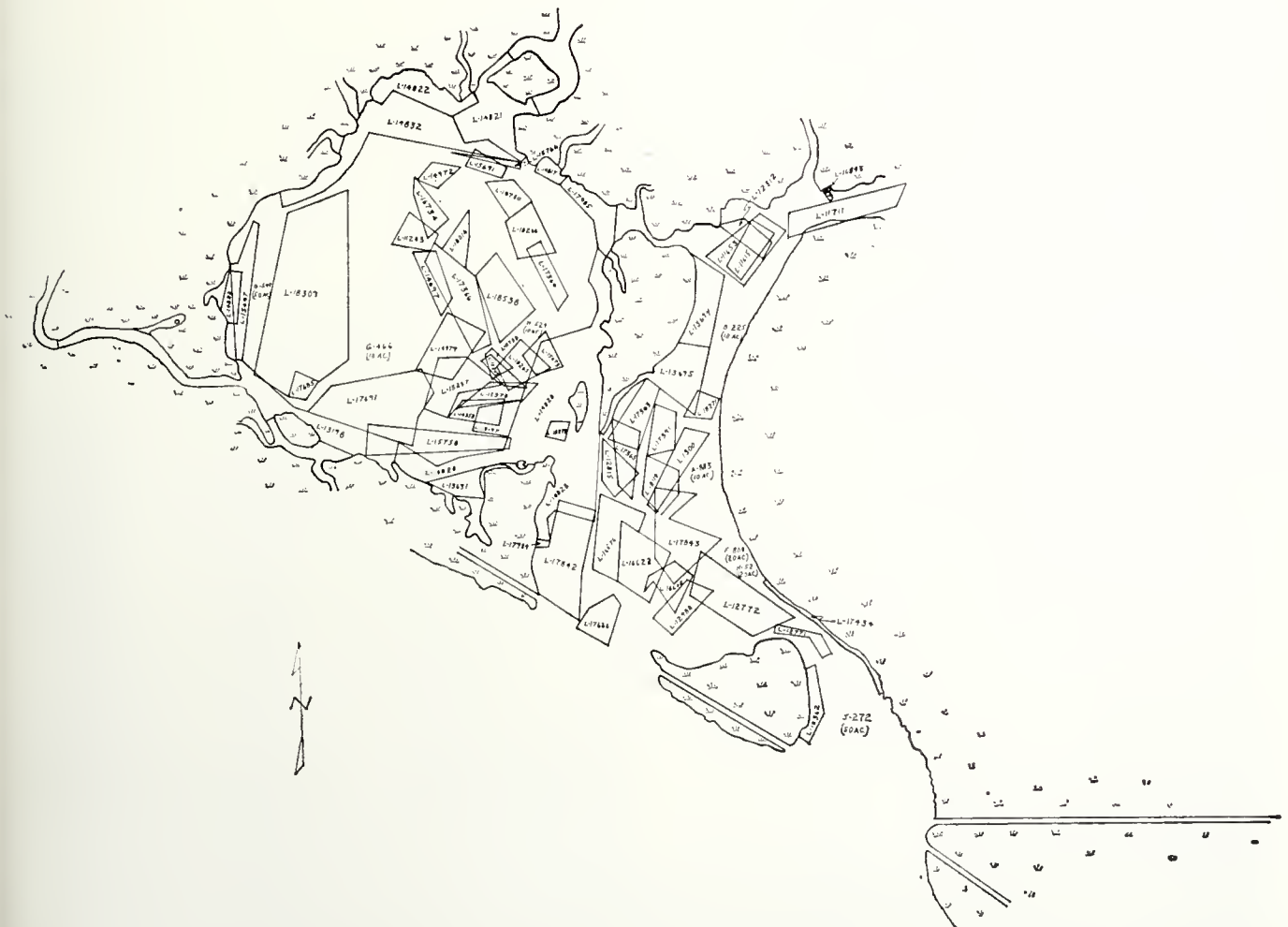
The table details the location and number of leases presently under control by survey monuments. Also indicated is the leasable acreage controlled by these monuments.

A total of 229 monuments have been traversed. The markers control 16,164 acres of leased water bottoms. An additional 47,290 acres of leasable

water bottoms are controlled by these monuments. An additional 600 monuments have been placed; these, however, are yet to be traversed.



**Quarter boat for oyster-lease survey party.**



**Before—Oyster lease control monuments in Bay Coquette.**



# Marine Biological Section

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## INTRODUCTION

The Marine Biological Section has provided an increased supply of technical information and research data to the fishing industry of Louisiana during the past biennium. For the most part the great impetus in research has been brought about by the extensive and intensive shrimp research program that has gradually become an annual procedure.

Marine seafood production in the northern Gulf ranks first in the United States. Louisiana's major rivers are the principal nutrient sources that make coastal Louisiana one of the most productive estuarine areas in the world.

Basically, the program of the marine biological section deals with the many phases of research needed to maintain our valuable shrimp and oyster fishery. In addition, work on commercial marine fishes, crabs and sport fish is contemplated. In general, the type of work being done may be categorized as follows.

1. Long range investigations: Aimed at improving seafood production and quality, also to alleviate various dilemmas of the industry.
2. Short range studies and field examination: Designed to furnish some immediate information which may be used by the Wild Life and Fisheries Commission in formulating rules, regulations and policy concerning marine problems.
3. Shrimp Research: An extensive research program on shrimp is being developed which deals with breeding, growth, movements and the effects of salinity and temperature.

4. Oyster Research: A program aimed at improving the state's production and quality of this valuable resource. Much work is planned toward controlling predators and disease. Preliminary work on oyster culture and seed production in ponds has been done and future work is planned.
5. Technical aid to oyster growers: This is an extension type service offered to the individual oyster grower. Upon official request, problems on individual oyster leases are investigated and reports prepared.
6. Development and management: Natural state seed grounds and oyster reservations are studied and managed annually to achieve maximum production. Supplemental seed oyster production is accomplished by shell plantings.
7. Plankton Research: A study of the basic food chain by the quantitative analysis of net and nannoplankton of the Barataria Bay system.
8. Cooperative research: Cooperative research is carried on with the Louisiana State University and other university and governmental research agencies interested in marine problems.
9. Education: The biological staff and the facilities of the marine laboratory are available and are frequently engaged in various cooperative educational programs with universities, colleges, and high schools of Louisiana. Short courses, field trips and lectures are provided for interested groups upon official request.
10. Water resources and pollution: Continued availability of maximum acreage of unpolluted estuarine area are a necessity if Louisiana's seafood industry is to survive and grow. The technical staff makes studies, prepares reports and acts in matters on interagency coordination where estuarine problems are concerned.
11. Other activities: Some time is spent in preparing papers and publications to be given at various meetings. The senior biologists are also active on various interstate and national committees, some of which are:
  - (a) Shellfish Research Committee, Gulf States Marine Fisheries Compact,
  - (b) Estuarine Technical Coordinating Committee, Gulf States Marine Fisheries Compact,
  - (c) Shrimp Research Committee, Gulf States Marine Fisheries Compact,
  - (d) Pollution Committee, South-eastern Section, American Fisheries Society.

During the past biennium, division biologists have made trips to Texas, Mississippi, Alabama, Florida and Maryland.

The following report will detail typical examples of the work outlined above and will describe the location and extent of the laboratory facilities

## RESEARCH HEADQUARTERS AND LABORATORY

The Commission's modern and extensive laboratory facilities were completed in 1960. Dormitory and duplex facilities and a 42,000 gallon freshwater cistern were added in 1965. When hurricane "Betsy" struck Louisiana's Coast in September, 1965, damage to all buildings and facilities was extensive. The main buildings remained structurally intact, but virtually everything at ground level was destroyed or carried away.

Repairs to laboratory facilities were completed at a cost of \$165,000. Damages from hurricane Camille in 1969 were light. During the past biennium, the following construction and repair work was completed.

1. Construction of sixteen one-fourth acre ponds for shrimp and fish culture.
2. Construction of hanger facilities for a sea plane and bulkheading of the area around it.
3. Construction of a new pump platform for the salt water system used to fill the ponds and storage tank.
4. Installation of two freshwater tanks by the workshop.
5. Construction of an off-ground lumber storage rack.
6. Replacement of slates blown off all buildings during hurricane Camille.
7. Repair of south wall of one of the one-fourth acre ponds which was washed out by hurricane Camille.
8. Construction of a sand levee on the gulf beach to slow down beach erosion.

## POND STUDIES

Pond studies of shrimp were begun at the lab in 1962 as reported in previous biennial reports. Construction of sixteen additional quarter acre ponds allowed the laboratory to increase the number of studies done on both the brown and white shrimp.

During 1968, twelve ponds were stocked with brown shrimp and four ponds with whites. Purina catfish chow was fed to brown shrimp at 5%, 10%, at a variable rate (0, 5%, 10%, 15%) and no feed as a control in eight ponds and at 3% of body weight daily in four ponds. As in previous studies, samples of 50 shrimp were taken weekly and weighed, then returned to their pond alive. Feeding rations were then adjusted to the average weekly weight gain. Results are given in Table I.

Table I  
1968 POND STUDIES

| Experiment No.           | Brown Shrimp |       |       |         |       |       |       |         |      |       |       |       | White Shrimp |       |       |         |
|--------------------------|--------------|-------|-------|---------|-------|-------|-------|---------|------|-------|-------|-------|--------------|-------|-------|---------|
|                          | B-13         | B-14  | B-15  | B-16    | B-17  | B-18  | B-19  | B-20    | B-21 | B-22  | B-23  | B-24  | W-8          | W-9   | W-10  | W-11    |
| Stocking Rate—M/Acre     | 20           | 20    | 20    | 20      | 20    | 20    | 20    | 20      | 8    | 12    | 16    | 20    | 20           | 20    | 20    | 20      |
| Stocking Weight—Lb/Acre  | 18.8         | 20.0  | 23.6  | 25.2    | 2.6   | 2.6   | 2.0   | 1.1     | 59.4 | 81.4  | 184.8 | 128.1 | 69.6         | 118.9 | 47.0  | 36.6    |
| Percent Fed Daily        | var.*        | 5     | 10    | control | 5     | 10    | var.* | control | 3    | 3     | 3     | 3     | 5            | 10    | var.* | control |
| Recovered—Lb/Acre        | 237.2        | 463.6 | 442.6 | 198.8   | 338.0 | 462.7 | 472.3 | 119.9   | 150  | 190.1 | 172.8 | 374.0 | 662.8        | 808.6 | 507.2 | 41.6    |
| Count/Lb                 | 43           | 41    | 38    | 88      | 47    | 34    | 41    | 27      | 30   | 35    | 29    | 37    | 28           | 23    | 36    | 38      |
| Mortality Percent        | 30           | 6     | 7     | 14      | 9     | 21    | 3     | 84      | 17   | 47    | 73    | 31    | 6            | 7     | 7.9   | 86.8    |
| Food Conversion Factor C | 7.0          | 2.3   | 3.8   | ....    | 1.7   | 4.1   | 3.5   | ....    | 4.9  | 6.0   | ....  | 3.9   | 3.0          | 3.4   | 3.9   | ....    |
| Duration Days            | 70           | 80    | 68    | 80      | 100   | 100   | 100   | 100     | 80   | 80    | 80    | 80    | 80           | 80    | 80    | 80      |

With brown shrimp in studies B 13 through B 20, growth was better with 10% variable feeding rates, but excessive mortalities generally occurred at these higher feeding rates. These were mainly due to oxygen depletions caused by several windless cloudy days. Heavily fed ponds usually had heavy plankton concentrations which in turn made those ponds more susceptible to oxygen depletions. Total production in the better ponds ranged from 388 to 472.3 pounds per acre.

The food conversion factor C, which is the pounds of feed required to produce a pound of shrimp, was lower at the 5% feeding rates. This C factor is very significant. The cost per pound of feed multiplied by the C factor gives the cost of feed per pound of shrimp raised. With any given feed, the rate of stocking or amount of daily feed which gives the lowest C factor will be the most economical. This would be very important in a commercial operation.

Studies B 21 through B 24 were designed to determine a suitable stocking rate when feeding at 3% of the total shrimp weight daily. Stocking rates ranged from 8,000 per acre to 20,000 per acre. Mortalities were high ranging from 17% to 73%. Production was very low with a maximum of 145.9 pounds per acre during the 80 day period.

White shrimp in studies W8 through W11 were fed Purina catfish chow at 5%, 10%, variable rates and no feed as a control. Mortalities were low except in the control pond. Production was high and food conversion factors were fairly low. The pond fed at 10% yielded 808 pounds per acre which was the highest yield reached so far in Marine Lab studies. This pond also yielded the largest shrimp produced so far. These were 23 to the pound.



Collecting shrimp grown experimentally in the small pond at the Marine Laboratory.

Table II  
1969 POND STUDIES

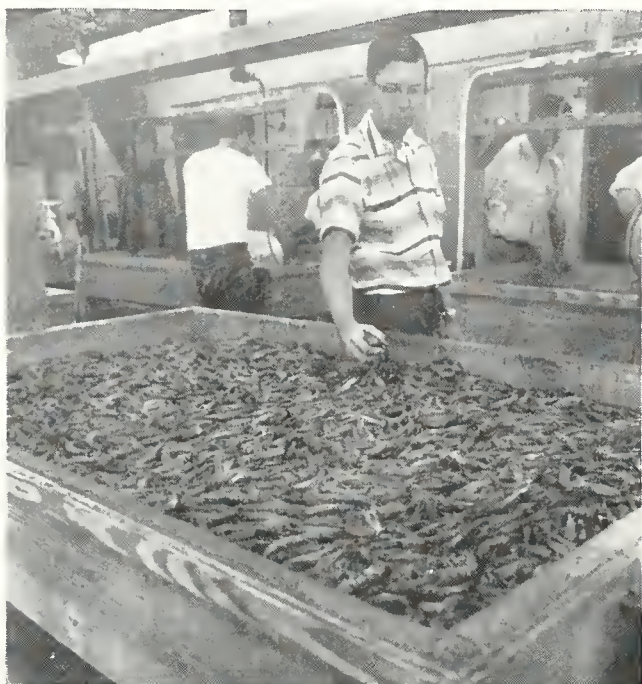
| Experiment No.                    | Brown Shrimp |              |       |       |       |       |              |              |      |       | White Shrimp |       |       |      |      |      |              |              |
|-----------------------------------|--------------|--------------|-------|-------|-------|-------|--------------|--------------|------|-------|--------------|-------|-------|------|------|------|--------------|--------------|
|                                   | B-25         | B-26         | B-27  | B-28  | B-29  | B-30  | B-31         | B-32         | B-33 | B-34  | B-35         | B-36  | W-12  | W-13 | W-14 | W-15 | W-16         | W-17         |
| Stocking Rate—<br>M/Acre .....    | 15           | 15           | 15    | 15    | 15    | 15    | 15           | 15           | 15   | 15    | 15           | 15    | 15    | 15   | 15   | 15   | 15           | 15           |
| Duration Days ...                 | 80           | 80           | 80    | 80    | 80    | 80    | 100          | 100          | 100  | 92    | 100          | 100   | 80    | 80   | 80   | 80   | 80           | 83           |
| Percent                           |              |              |       |       |       |       |              |              |      |       |              |       |       |      |      |      |              |              |
| Fed Daily .....                   | 2.5F<br>2.5P | 2.5F<br>2.5C | 5C    | 5P    | 5F    | None  | 2.5F<br>2.5P | 2.5F<br>2.5C | 5C   | 5P    | 5F           | None  | None  | 5F   | 5P   | 5C   | 2.5F<br>2.5P | 2.5F<br>2.5C |
| Stocking Weight—<br>Lb/Acre ..... | 10.6         | 14.9         | 8.24  | 14.9  | 14.9  | 14.9  | 27.6         | 26.8         | 25.4 | 24.4  | 27.4         | 26.4  | 25.2  | 29.7 | 68.4 | 25.8 | 38.6         | 4.96         |
| Recovered—<br>Lb/Acre .....       | 435.6        | 434.6        | 376.8 | 389.0 | 316.4 | 92.5  | 273.6        | 449.2        | 92.8 | 333.4 | 337.8        | 202.4 | 262   | 457  | 488  | 503  | 457          | 349          |
| Mortality                         |              |              |       |       |       | *     |              |              |      |       |              |       |       |      |      |      |              |              |
| Percent .....                     | 5.4          | 10.6         | 15.3  | 10.4  | 3.6   | *     | 38.9         | 3.2          | 62.4 | 19.3  | 33.8         | 14.1  | 2.3   | 9.0  | 6.3  | 1.6  | 7.2          | 6.9          |
| Food Conversion                   |              |              |       |       |       |       |              |              |      |       |              |       |       |      |      |      |              |              |
| Factor C .....                    | 2.19         | 2.19         | 2.34  | 2.30  | 1.64  | ..... | 4.7          | 2.9          | 12.6 | 3.5   | 4.0          | ..... | ..... | 2.4  | 2.7  | 2.3  | 2.9          | 2.19         |
| Count/Lb .....                    | 33           | 31           | 34    | 34    | 57    | 100   | 33           | 32           | 54   | 36    | 29           | 63    | 56    | 30   | 29   | 30   | 29           | 41           |

F = ground fish  
P = Purina catfish chow  
C = cornmeal  
\* = 5001 recovered

In 1969 brown and white shrimp were stocked at the rate of 15,000 per acre. The shrimp were fed at 5% of their body weight daily. Feeds used were Purina catfish chow, cornmeal, ground industrial fish and combinations of the fish with the two dried foods. One control pond receiving no supplemental feed was included in each group of six ponds. Two groups of six ponds each were run with brown shrimp, one was run for 80 days and the other for 100 days. One group of six ponds was run with white shrimp for 80 days.

Results of the 1969 pond studies are given in Table II. In the 80 day study with brown shrimp the production was higher and food conversion was lower in those ponds fed the ground fish in combination with the corn meal and fish chow. Growth rates were comparable in all but those fed ground fish and those not fed. Lowest production was obtained with ground fish alone. The control pond in this group was accidentally overstocked at the beginning of the study.

The second group of brown shrimp went 100 days and these experienced several kills due to oxygen depletion during windless, cloudy days while the ponds were being fed heavily. It was determined that 60 pounds per acre was the maximum safe limit for feeding ground fish at the stocking density used. More than this resulted in partial kills. The only pond in this group with a low mortality rate was that fed cornmeal and ground fish. Production in it was comparable to those from the 80 day study and the food conversion factor was only slightly higher.



Shrimp grown in the research ponds at the Marine Laboratory.

In the 80 day study with white shrimp, comparable results were obtained in the fed ponds with the exception of that one fed with ground fish and cornmeal. This pond has been stocked later than the others and two things happened which slowed their growth. During the last month of the study the water temperature dropped below that which is optimum for shrimp growth and shrimp were unable to obtain sufficient quantities of ground fish. Prior to this time their growth pattern was similar to the others in the group.

## SHRIMP SPAWNING FACILITIES

One of the biggest problems in the experimental shrimp studies done at the Marine Laboratory has been obtaining suitable numbers of small shrimp for pond studies. At times there is no problem obtaining suitable numbers of small shrimp but this is the exception rather than the rule. There have been times when several weeks of intensive trawling were required for stocking just one of our quarter-acre ponds.

These difficulties may be minimized by setting up a shrimp spawning facility at the Marine Laboratory. At the present time, one of the laboratory rooms has been modified into a dual-purpose facility. One phase will be devoted to the mass culture of one-celled algae called diatoms. These will be used to feed the earlier stages of the shrimp larvae while they feed on one-celled plants. The other phase is a facility for spawning the adult shrimp and raising the larvae. Brine shrimp will be raised in this section and will be used as feed when the larvae reach the carnivorous stages of their development. The procedures to be used will be similar to those used by the Bureau of Commercial Fisheries Laboratory in Galveston, Texas, in their shrimp spawning facilities.

Most of the equipment needed for this work has been received and installed and shrimp spawning work should begin at the lab in early 1970.

## PLANKTON PRODUCTION STUDY

Plankton are mostly microscopic plants and animals that provide basic food energy directly or indirectly to all types of life in water. Animals which feed on the lower food levels such as plankton have a greater amount of food energy available to them. Many species that directly derive their food energy from plankton comprise some of the most voluminous fisheries in the world.

Plankton feeder species comprised an average of 45% of the total United States catch from 1962 to 1966, and in Louisiana alone in 1968, 83.2% by weight and 30% by value of total fishery catch was made of plankton feeders. Plank-

ton, therefore, present a readily available energy source and its quantitative abundance determines the general fertility and extent of magnitude of fisheries it could support.

The work on plankton production and nutrition available from plankton was initiated at the Marine Lab in December, 1967. Since then 25 cruises have been conducted, sampling on pre-established stations in Barataria Bay and its adjacent estuarine systems including an off-shore station. Field operations were conducted during the yearly cycle and seasonal changes were taken into consideration. Because conventional tow net collection techniques lack exact quantitative measure, a calibrated pumping system was employed for plankton samplings. Since many organisms such as the oyster are size selective in the food which they utilize, plankton studies were carried out on two size fractions. There were net plankton (those larger than 76 micron and retained in the net during pumping operations) and nanoplankton recovered from the net filterate.

Dry biomass values were determined for each of the plankton fractions, and nutrients such as proteins, carbohydrates and lipids, were expressed as gram per square meter (from square meter on surface to bottom). Nanoplankton samples were too small for estimation of lipid content.

Table I summarizes the data for one complete standing biomass and nutrient cycle. Mean dry weight of net plankton (0.394 g/sq m) and nanoplankton (44.730 g/sq m) pointed to remarkably high fertility and productiveness of Barataria Bay, its adjacent estuarine systems and coastal areas. A comparison with similar studies of Mississippi waters also suggested extremely rich basic food sources present in Louisiana waters. Louisiana's large fisheries catches of 15.9% and 18.2% of the total U. S. catches for 1967 and 1968 were due in part to favorable early growth

conditions in our plankton rich estuaries. Menhaden directly consumes plankton and is the major commercial fish. Menhaden catch in Louisiana for 1968 was 622 million pounds. The oyster, another direct plankton consumer, is the most important shellfish next to shrimp.

Vast marshlands and river inlets continuously pour detritus laden, nutrient-rich water into estuaries and coastal areas. Findings of the present research showed areas closer to detritus source and comparatively in shallower water had higher standing crop per unit water volume. Periodic identification of plankton types in the cruise samples and other plankton studies by the Oyster Division biologists also showed that the young stages of many commercially important species of fish and shellfish use the inshore protected areas as nurseries. Estuaries must, therefore, provide a rich source of basic food for many commercially important species. Success of young stages during the nursery period should then determine the extent of recruitment of adult stocks of fish and shellfish from year to year. Research showed a large amount of available food in the form of plankton in these estuaries. This will indirectly reflect in the commercial catches in Louisiana.

Several other important observations were made during the course of research. Plankton collected at any time contained about 80% of detritus, indicating that richness in Louisiana estuaries primarily was due to influx of decaying leaves and bits of marshland vegetation that is brought in by wind, rain and rise and fall of water levels.

Results showed nanoplankton values, which are overlooked in most plankton studies, comprised the major part of total plankton and 113 times higher than net plankton. Nanoplankton

**Table I**  
**SEASONAL VARIATIONS IN DRY WEIGHT AND NUTRIENTS DURING A YEARLY CYCLE**

| Date<br>1968 | NET PLANKTON            |                   |                             |                 | NANOPLANKTON            |                   |                             |
|--------------|-------------------------|-------------------|-----------------------------|-----------------|-------------------------|-------------------|-----------------------------|
|              | Dry<br>Weight<br>g/sq m | Protein<br>g/sq m | Carbo-<br>hydrate<br>g/sq m | Lipid<br>g/sq m | Dry<br>Weight<br>g/sq m | Protein<br>g/sq m | Carbo-<br>hydrate<br>g/sq m |
| 28 Feb.      | 0.289                   | 0.062             | 0.005                       | 0.002           | 56.500                  | 3.280             | 0.601                       |
| 30 March     | 1.222                   | 0.058             | 0.029                       | 0.009           | 138.080                 | 2.456             | 0.606                       |
| 2 April      | 0.354                   | 0.048             | 0.007                       | 0.006           | 46.850                  | 2.632             | 0.498                       |
| 30 April     | 0.328                   | 0.066             | 0.006                       | 0.004           | 38.550                  | 3.477             | 1.268                       |
| 22 May       | 0.237                   | 0.123             | 0.029                       | 0.005           | 43.740                  | 3.416             | 1.820                       |
| 12 June      | 0.445                   | 0.059             | 0.048                       | 0.006           | 60.290                  | 3.459             | 7.898                       |
| 7 July       | 0.552                   | 0.031             | 0.013                       | 0.003           | 55.750                  | 4.052             | 3.309                       |
| 23 July      | 0.111                   | 0.010             | 0.016                       | 0.006           | 24.620                  | 1.191             | 2.469                       |
| 8 Aug.       | 0.150                   | 0.017             | 0.015                       | 0.004           | 24.930                  | 1.282             | 0.673                       |
| 28 Aug.      | 0.164                   | 0.022             | 0.005                       | 0.002           | 46.770                  | 2.296             | 0.713                       |
| 24 Sep.      | 0.219                   | 0.043             | 0.006                       | 0.001           | 31.570                  | 2.375             | 0.359                       |
| 9 Oct.       | 0.278                   | 0.027             | 0.011                       | 0.002           | 16.830                  | 1.868             | 0.604                       |
| 14 Nov.      | 0.384                   | 0.016             | 0.009                       | 0.003           | 21.710                  | 0.847             | 0.468                       |
| 1969         |                         |                   |                             |                 |                         |                   |                             |
| 26 Feb.      | 0.783                   | 0.037             | 0.012                       | 0.002           | 20.080                  | 1.321             | 0.389                       |
| Grand Mean   | 0.394                   | 0.044             | 0.015                       | 0.004           | 44.730                  | 2.430             | 1.550                       |

is the exclusive food of oysters and the primary food of all plankton feeders. Nannoplankton, therefore, provides an important tool to measure energy at the basic food level more precisely than possible before. Although the levels of proteins and carbohydrates were lower in nannoplankton, the total available nutrients in unit water volume were considerably higher than those of net plankton.

Results of the present study show the standing crop of basic food during the yearly cycle and provides information to understand and possibly measure the extent and magnitude of fisheries that directly depend upon this basic food source. The information should also be of potential value for prediction of certain fisheries.

### RED TIDE STUDY

Blooms of microscopic organisms that are popularly known as Red Tide often result in massive fish kills. These mass mortalities cause much concern to fishermen, sportsmen, and fisheries related agencies. While such catastrophes may not bring down the fish and shellfish populations to critical levels, the littering of beaches with decaying fish and discolored odorous water may be unpleasant and discouraging to fishermen.

When fish kills occur, biologists try to determine the cause, whether it might be natural, from pollution or from fishing operations. Grand Terre Marine Laboratory conducts routine checks, especially during the suspected period in summer. Pollution laboratory and Aviation Division also assists in locating and surveying fish kill areas and in sampling.

Causes of fish kills in Louisiana so far identified are blooms of a group planktonic organisms called dinoflagellates. Growth promoting factors are calm winds, salinity above 30 parts per thousand and temperature between 17°C and 27°C. Toxic metabolites released from dinoflagellates are injurious to finfish, some shellfish and occasionally cause mass mortalities. During June,



Fish presumed killed off the Louisiana Coast by the "Red Tide" organism.

1968, and 1969, several million fish were reported killed by the red tide. Control of naturally caused fish kills is difficult or impossible at the present time. The primary purpose of the red tide program is to identify the causes and extent of fish kill for various fisheries interests and to guard against possible pollution.

### Gulf of Mexico Estuarine Inventory

FEDERAL AID PROJECT 2-22-R

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### GULF OF MEXICO ESTUARINE INVENTORY

The Gulf of Mexico Estuarine Inventory and Study was designed to show the importance and value of Gulf Coast estuaries and their role as nursery grounds and basic contributors to the size and success of the Gulf of Mexico fisheries. A major goal of the inventory project is to obtain comparable data for all Gulf Coast estuaries. This is being accomplished through cooperative efforts of Alabama, Mississippi, Louisiana and the U. S. Bureau of Commercial Fisheries Laboratories at Galveston, Texas, and St. Petersburg Beach, Florida.

Comparable data is being obtained by the use of standard sampling techniques and procedures. These common procedures were agreed upon by participants of the Estuarine Technical Coordinating Committee of the Gulf States Marine Fisheries Commission. This is the group that is responsible for the standardization of sampling methods and procedures.

The close of the 1968-1969 fiscal period ended the field sampling for this program. The next fiscal period will be spent compiling, analyzing,

and presenting this data in an Atlas of the Estuaries of the Louisiana Coast.

## Phase I—Area Description

Participants of the Estuarine Technical Coordinating Committee agreed upon the use of 1:250,000 scale maps to show priority items. Any additional details that need to be shown will be mapped at a scale best suited for that purpose.

The measurements of the surface water areas and water volumes of the estuaries of coastal Louisiana have been completed. These calculations were made with a planimeter at three foot depth contours (where depths were available) using the latest 1:24,000 and 1:62,500 scale maps, from the Intracoastal Canal south to the shoreline. Calculations do include Lake Pontchartrain and Lake Maurepas. When depths are not available on the charts, 1½ feet average depth was used for lakes and bayous, and 4½ feet average depth for canals, ditches and channels. The total surface area of the estuarine zone in Louisiana was calculated to be 3,533,243 acres, and the total water volume was 22,653,294 acre-feet.

During 1968 a cooperative vegetative study of the Louisiana coastal marshes was completed. Co-operating agencies were the Louisiana Wild Life and Fisheries Commission, the Louisiana Cooperative Wildlife Research Unit at Louisiana State University, and the U. S. Army Corps of Engineers.

Field personnel in helicopters flew transects over the Louisiana coastal zone and have prepared a vegetative type map of the Louisiana marshes. Table I presents a breakdown of the marsh types and acreage within each type. Of the total acreage (3,960,664 acres) of this coastal zone, fresh and brackish marsh areas make up approximately 61 percent of this total.

Information has been obtained which will give discharge figures for principal streams entering the estuaries. Discharge data on the following major streams will be included in the Atlas of Louisiana Estuaries: Sabine River, Calcasieu River, Mermentau River, Vermilion River, Atchafalaya River, Bayou Teche, Bayou Lafourche, Mississippi River, and Pearl River.

Table I

### VEGETATIVE TYPE MAP OF THE LOUISIANA COASTAL MARSHES

| Type                       | Acre      |
|----------------------------|-----------|
| Saline Marshes .....       | 862,973   |
| Fresh Marshes .....        | 1,193,325 |
| Brackish Marshes .....     | 1,203,790 |
| Intermediate Marshes ..... | 620,576   |
| Non-Marsh Areas .....      | 80,000    |
| Total .....                | 3,960,664 |

Population statistics of parishes and cities bordering estuarine study areas in Louisiana have been obtained. The 1960 census of Louisiana showed the population density of the state to be 72.2 persons per square mile. The 1960 population density of the sixteen parishes bordering estuarine study areas in Louisiana was 116.9 persons per square mile. Of these coastal parishes, however, ten were below the state average of 72.2 persons per square mile. The increase in the number of persons per square mile in this coastal area is due to Orleans and Jefferson Parishes whose metropolitan populations are extremely large.

By using the 1969 projected population estimates, the average number of persons in parishes bordering estuarine study areas in Louisiana increased to 133.3 persons per square mile. This was an increase of 218,974 persons, or approximately 14.9 percent. The population density of Cameron Parish increased by only 0.7 persons per square mile, whereas, Orleans Parish had an increase of 316.6 persons per square mile.

The commercial fisheries shore plant installation in Louisiana for 1967 have been obtained. The value of processed products during the year was over \$68,000,000. The highest value for a single parish was over \$18,000,000 for Jefferson Parish.

Most of the data on industrial, municipal and domestic wastes emptying into estuarine areas and their tributaries along the Louisiana Coast has been obtained, and is in the process of being placed in the accepted tabular format.

## Phase II—Hydrology

All of the required hydrology parameters (salinity, water temperatures, dissolved oxygen, tidal fluctuations, and water samples for nitrate, nitrite, phosphate, and total phosphorus analysis) have been measured during this biennium. This data has been placed on the Gulf of Mexico Estuarine Inventory Coding Forms for all areas. In addition, the chemical determinations for Areas V and VI have been coded.

Figure 1 shows the average monthly water temperature and salinity for stations in each study area. The highest average water temperature (33°C—Centigrade) occurred in July, 1968, in Area VI. The lowest average water temperature (10°C) occurred in January, 1969, in Area VI. The highest average salinity (24.2 ppt—parts per thousand) occurred in November, 1968, in Area VI. The lowest average salinity (3.0 ppt) occurred in April, 1969, in Area VI.

As expected, the graph of water temperatures show the descending values of the winter months (November through March) and the ascending values for the spring and summer months (April through July).

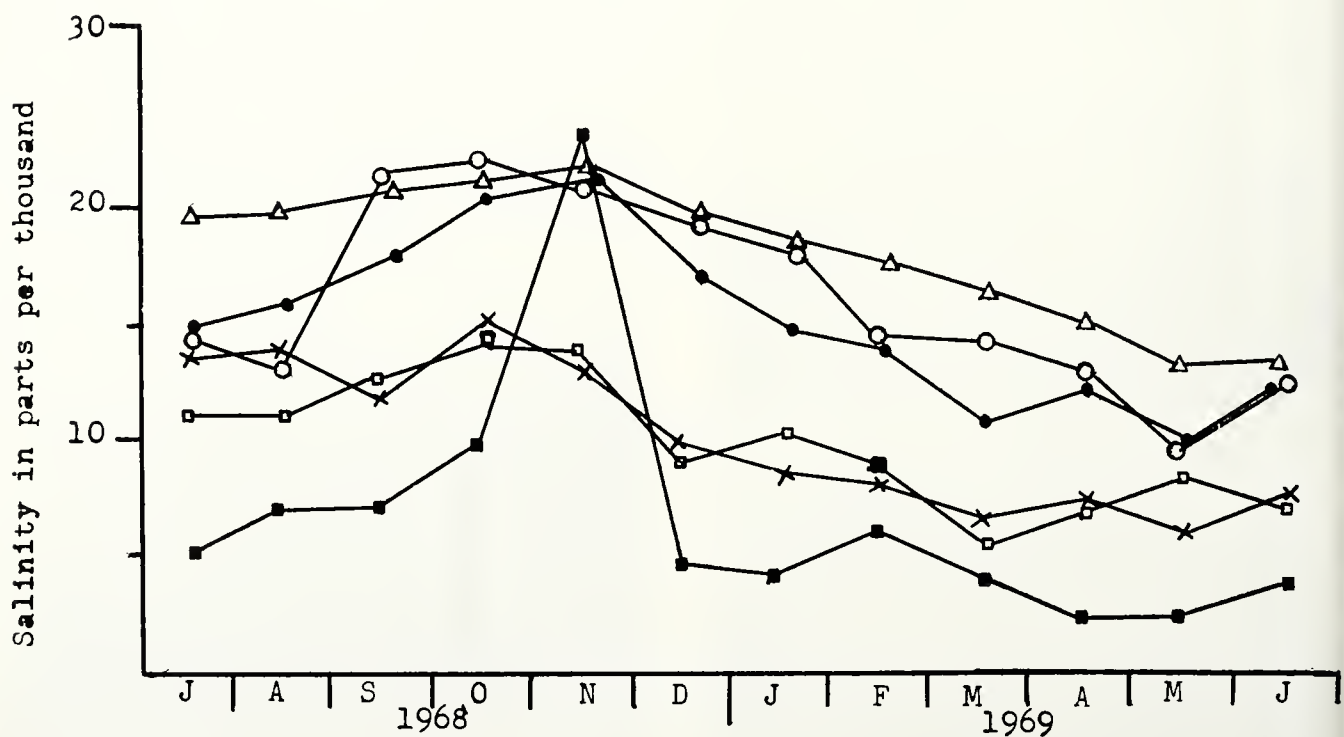
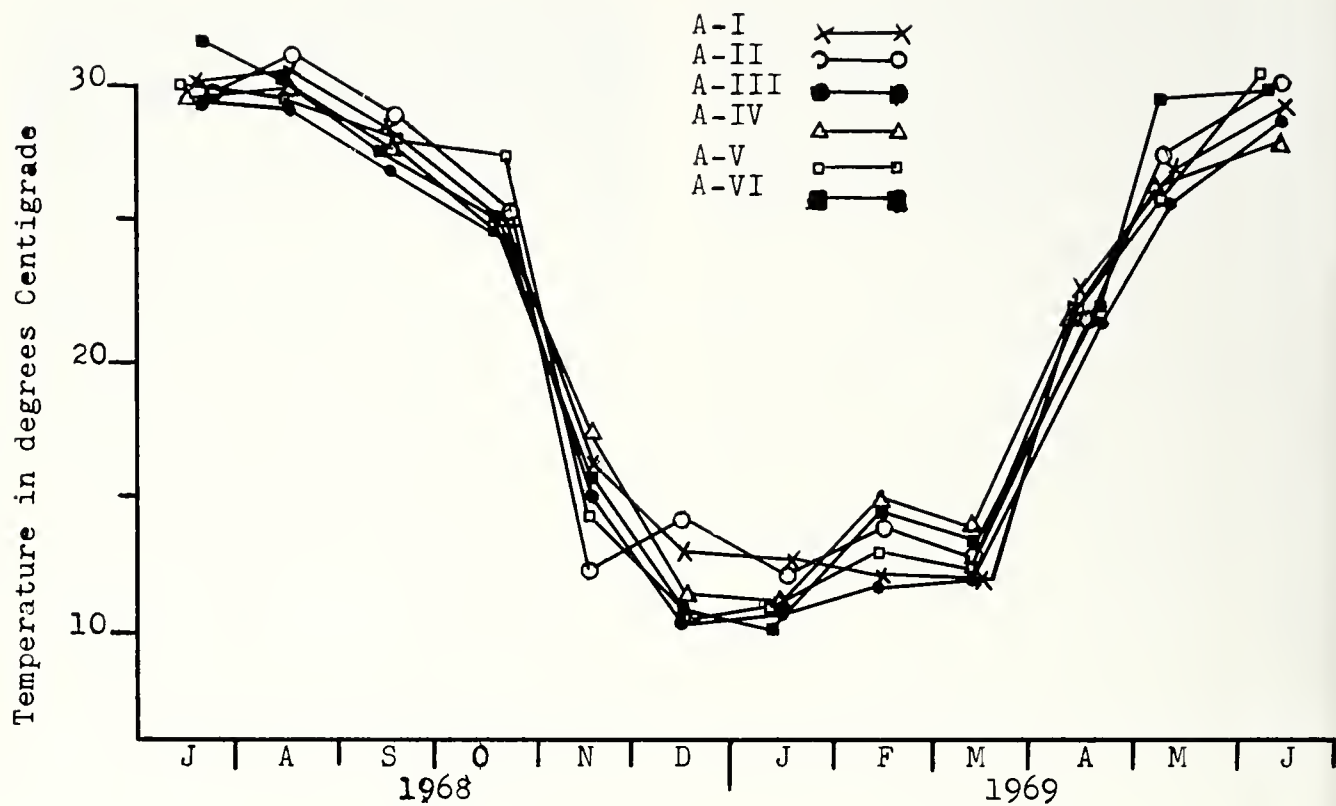


Figure 1. Monthly average water temperature and salinity for sampling stations in Study Areas I. through VI.



Constant recording instruments are used coastwide to monitor salinity, water temperature and tidal fluctuations. Here, a marine biologist is changing the weekly chart of salinity recordings.

In comparing data from 1967–1968 with 1968–1969, it was found that monthly average salinities were generally lower during the 1968–1969 fiscal period than during the preceding year. These lower salinity values were probably caused by an increase in local rainfall and high river stages. Water temperatures have exhibited generally the same pattern as seen in previous years. Cold fronts occurred during the winter months and lowered water temperatures; however, in March temperatures began to rise (Figure 1).

The concentrations of nitrates, nitrites, inorganic phosphate and total phosphorus have been measured monthly during this biennium. Approximately 600 water samples have been analyzed. Results show variances in nutrients from station to station and from month to month. Variances in concentrations are due primarily to river discharge, drainage area, and the chemical composition of the soils in the drainage area. The high nitrate concentration found in certain areas is probably due to the influence of the Atchafalaya and Mississippi Rivers.

### Phase III—Sedimentology

Field techniques for core sampling continued unchanged during this biennium. Approximately 1,300 core samples have been analyzed for grain size and color. The predominant grain size continues to be fine particles (silts and clays), and the majority of the sand size fractions is very

fine sand. An exception to this is in Area VI (Calcasieu Lake). Analysis of samples taken in this area contained a high composition of sand, and a low percentage of organic matter. Many of the samples from Areas I and II contained a very high organic content in the form of vegetation remnants.

Field data, relative to salinity, water temperature, current, wave action, and bottom type, is recorded at each core sampling station. Some of the data has been entered on the Gulf of Mexico Estuarine Inventory Coding forms. In some cases, the grain size analysis and color code data have also been entered on the coding forms.

Area IV has tentatively finished its field core sampling. Areas I, III and V are approximately 80 percent completed, and Areas II and VI are approximately 50 percent completed.

### Phase IV—Biology

All biological samples made during this biennium utilized gear types that were in accordance with those prescribed for use by the Estuarine Technical Coordinating Committee. Those were: 16 foot trawls,  $\frac{1}{4}$  inch bar mesh tail and  $\frac{3}{4}$  inch bar mesh body, 100 foot seine of  $\frac{1}{4}$  inch bar mesh and a circular  $\frac{1}{2}$  meter plankton net.

An average of three samples per month for 28 stations along the Louisiana Coast were analyzed for approximate zooplankton biomass (counts/ $m^3$ ) and identification and counts of plankters present in each sample. Total counts ranged from nothing in the sample but Ctenophore fragments to 356,000 per  $100m^3$ . Copepods, in general, make up the bulk of the plankton. Thirty-nine genera and some 30 species have been identified from the samples so far. In most cases, the copepods of the genus, *Acartia*, were the dominant members of the zooplankton. Species identified are *Acartia tonsa*, *A. bermudensis*, and *A. spinata*. *Acartia tonsa* was the most abundant species and was present in almost every sample. Maximum count of this species was 308 per  $m^3$ . This species was present regardless of temperature and salinity. Ctenophore fragments (*Beroe ovata*) were abundant in many of the samples and plankton counts were generally low in samples where the ctenophore and medusae counts were high. This was probably due to net clogging and subsequent washout of zooplankton members. The protozoan, *Noctiluca*, was occasionally extremely abundant. The Chaetognath, *Sagitta hispida*, was at times present in large numbers. Other plankters occurring frequently were *Oikopleura dioica*, *Mysidopsis almyra*, *Leander tenuicornis*, *Acetes caroliniae*, *Temora turbinata*, *Labidocera aestiva* and the cladocerans. Meroplanktonic forms such as nauplii, megalops larvae and fish eggs were often abundant, particularly in spring and early summer samples. Other meroplanktonic forms includ-

ed various decapod larvae, pagurid larvae, Sergistid larvae, Echinoderm larvae and porcellanid zoea.

There were 11 species of shrimp collected by 16 foot trawl during this biennium. Of the species recorded, the commercially important white shrimp, *Penaeus setiferus*, and brown shrimp, *Penaeus aztecus*, occurred in greater numbers in the trawl catches than any other crustacean. Over 80,000 Penaeid shrimp were taken. The greater number of white and brown shrimp were taken in Area V. The greatest number of pink shrimp, *Penaeus duorarum*, occurred in Area III. Over 8,000 blue crabs, *Callinectes sapidus*, were taken during this sampling period. The greatest number occurred in samples from Area V.

The bay anchovy, *Anchoa mitchilli*, was the most abundant fish taken; over 250,000 anchovies occurred in the samples. The largest number was taken in Area III.

Commercially important Seiaenids also occurred in large numbers in the samples. There were 12 members of this family taken during the sampling period. Of these, the Atlantic croaker, *Micropogon undulatus*, occurred in greatest number; over 140,000.

The most abundant species collected in the trawl and seine samples are presented in Table 2. This table presents a breakdown by commercial vertebrate and invertebrate species and by non-commercial vertebrate and invertebrate species. The Atlantic croaker accounted for approximately 50 percent of the commercial vertebrate catch, and the brown shrimp made up 65 percent of the commercial invertebrate catch. The bay anchovy made up 85 percent of the non-commercial vertebrate catch, and the grass shrimp, *Palemonetes vulgaris*, accounted for over 60 percent of the non-commercial invertebrate catch.

The data collected during this study show the seasonal catches of certain fishes and crustaceans in our estuarine zone. These data document the importance of these areas to the development and perpetuation of these organisms, for it is in the estuarine zone that many of these species grow and mature. Loss of these valuable estuaries would be detrimental to commercial and sports fishing interests in Louisiana and other coastal areas since the estuarine zone contributes so greatly to our fisheries' production.



This is the standard research vessel used in the research program. The 16-foot otter (shrimp) trawl is one type of gear used in sampling juvenile fishes and crustaceans.

Table 2

TOTAL NUMBER, 200 OR GREATER OF LOUISIANA TRAWL AND SEINE  
CATCH BY SPECIES, APRIL, 1968, THROUGH MARCH, 1969, SHOWING  
NUMBER OF SAMPLES (IN PARENTHESES) AND PERCENT OF TOTAL

|                                  | Trawl<br>(No. Smpls) | Seine<br>(No. Smpls) | Total<br>(No. Smpls) | Percent |
|----------------------------------|----------------------|----------------------|----------------------|---------|
| <i>Commercial species</i>        |                      |                      |                      |         |
| Vertebrate                       | 1,390                | 130                  | 1,520                |         |
| <i>Alosa aestivalis</i>          | 1,421                | 0                    | 1,421                | .48     |
| <i>Alosa sapidissima</i>         | 257                  | 4                    | 261                  | .09     |
| <i>Brevoortia patronus</i>       | 25,532               | 62,955               | 88,487               | 30.01   |
| <i>Dorosoma cepedianum</i>       | 564                  | 40                   | 604                  | .20     |
| <i>Bagre marinus</i>             | 2,047                | 180                  | 2,227                | .76     |
| <i>Galeichthys felis</i>         | 4,903                | 2,312                | 7,215                | 2.45    |
| <i>Ictalurus furcatus</i>        | 175                  | 295                  | 470                  | .16     |
| <i>Caranx hippos</i>             | 259                  | 21                   | 280                  | .09     |
| <i>Bairdiella chrysura</i>       | 695                  | 313                  | 1,008                | .34     |
| <i>Cynoscion arenarius</i>       | 6,176                | 229                  | 6,405                | 2.17    |
| <i>Cynoscion nebulosus</i>       | 128                  | 366                  | 494                  | .17     |
| <i>Leiostomus xanthurus</i>      | 27,302               | 1,238                | 28,540               | 9.68    |
| <i>Menticirrhus americanus</i>   | 251                  | 168                  | 419                  | .14     |
| <i>Micropogon undulatus</i>      | 136,028              | 8,613                | 144,641              | 49.05   |
| <i>Chaetodipterus faber</i>      | 694                  | 38                   | 732                  | .25     |
| <i>Trichiurus lepturus</i>       | 325                  | 13                   | 338                  | .12     |
| <i>Prionotus tribulus</i>        | 489                  | 62                   | 551                  | .19     |
| <i>Poronotus triacanthus</i>     | 364                  | 12                   | 376                  | .13     |
| <i>Mugil cephalus</i>            | 1,155                | 1,268                | 2,423                | .82     |
| <i>Menidia beryllina</i>         | 91                   | 4,634                | 4,725                | 1.60    |
| <i>Citharichthys spilopterus</i> | 681                  | 90                   | 771                  | .26     |
| <i>Etropus crossotus</i>         | 286                  | 21                   | 307                  | .10     |
| <i>Paralichthys lethostigma</i>  | 505                  | 172                  | 677                  | .23     |
| <i>Trinectes maculatus</i>       | 1,479                | 36                   | 1,515                | .51     |
| TOTALS                           | 211,807              | 83,080               | 294,887              |         |
| <i>Invertebrate</i>              |                      |                      |                      |         |
| <i>Rangia cuneata</i>            | 421                  | .....                | 421                  | .45     |
| <i>Penaeus setiferus</i>         | 22,206               | 536                  | 22,742               | 24.11   |
| <i>Penaeus durarum</i>           | 371                  | 31                   | 402                  | .43     |
| <i>Penaeus aztecus</i>           | 58,499               | 3,596                | 62,095               | 65.83   |
| <i>Callinectes sapidus</i>       | 8,131                | 535                  | 8,666                | 9.19    |
| TOTALS                           | 89,628               | 4,698                | 94,326               |         |
| <i>Other species</i>             |                      |                      |                      |         |
| Vertebrate                       |                      |                      |                      |         |
| <i>Alosa chrysochloris</i>       | 4                    | 302                  | 306                  | .10     |
| <i>Dorosoma petenense</i>        | 600                  | 181                  | 781                  | .27     |
| <i>Anchoa hepsetus</i>           | 591                  | 384                  | 975                  | .33     |
| <i>Anchoa mitchilli</i>          | 222,986              | 27,573               | 250,559              | 85.12   |
| <i>Synodus foetens</i>           | 648                  | 5                    | 653                  | .22     |
| <i>Fundulus similis</i>          | 44                   | 507                  | 551                  | .19     |
| <i>Chloroscombrus chrysurus</i>  | 2,623                | 171                  | 2,794                | .95     |
| <i>Membras martinica</i>         | 2,029                | 21                   | 2,050                | .69     |
| <i>Polydactylus octonemus</i>    | 27,352               | 3,858                | 31,210               | 10.60   |
| <i>Achirus lineatus</i>          | 351                  | 13                   | 364                  | .12     |
| <i>Symphurus plagiusa</i>        | 471                  | 65                   | 536                  | .18     |
| <i>Sphaeroides nephelus</i>      | 3,374                | 217                  | 3,591                | 1.22    |
| TOTALS                           | 261,073              | 33,297               | 294,370              |         |
| <i>Invertebrate</i>              |                      |                      |                      |         |
| <i>Loliguncula brevis</i>        | 1,051                | 26                   | 1,077                | 11.93   |
| <i>Acetes americanus</i>         | 1,312                | 804                  | 2,116                | 23.99   |
| <i>Palemonetes vulgaris</i>      | 5,061                | 508                  | 5,569                | 61.68   |
| <i>Callinectes danae</i>         | 249                  | 18                   | 267                  | 2.96    |
| TOTALS                           | 7,673                | 1,356                | 9,029                |         |

## AREA I Clam Shell Study

JOHNNY TARVER  
Study Leader

A new project entitled "A study of the Clam *Rangia cuneata* in Lake Pontchartrain and Lake Maurepas, Louisiana" was fully implemented in July, 1969. The brackish water clam, *Rangia cuneata*, is a common inhabitant of the estuaries of the Gulf Coast. The common *Rangia* is a commercially important species in several of the Gulf coast states and contributes substantially to the states' economy. In Louisiana, severance taxes and royalties collected from commercial harvest amounts to approximately \$1,500,000 annually, of which the Louisiana Wild Life and Fisheries Commission received \$500,000. This money is used in the operation of a marine conservation division.

Dredging in Lake Pontchartrain was begun in the middle 1930's when it was discovered that large quantities of *Rangia* shell could be removed with sweeper dredges. Clam shell production has gradually increased over the years to the point where they are currently being removed from Lake Maurepas and Pontchartrain at the rate of 5,000,000 cubic yards annually valued over \$12,000,000.

Clam shells are used in general construction, road construction, the production of cement and lime, in the petroleum and chemical industries, and in poultry and livestock feed. The living clams are a source of nutrition for many important species.

The objectives of this project are (1) to determine the clam shell stocks and the rate of replenishment of clam shell being harvested, (2) to determine the factors effecting the distribution, density, growth and reproduction of the clam in Lake Pontchartrain and Lake Maurepas, Louisiana, and (3) to evaluate the effects of harvesting methods on the environment. It is necessary that to learn more about these factors in order that we may best utilize this important resource and establish needed management procedures through wise regulations. This information would be extremely valuable to other states also having a clam shell industry.

To sample the populations of *Rangia*, two sampling techniques are utilized: benthic and planktonic. Bottom samples are taken with a modified oyster dredge and a Peterson dredge throughout Lakes Pontchartrain and Maurepas and their

major tributaries to determine the distribution and density of the clam population. Sixteen selected areas are sampled on a monthly basis to determine growth rate, recruitment and shell production. The clams are measured, counted, and a representative portion of each sample are sexed. In the event that more than 100 clams are dredged up at any one location, only 100 are measured. Depth, bottom type, salinity, temperature, and turbidity are recorded with each sample. Growth rates are determined by measuring the clams and marking numerals on the clam shell with a high speed drill. The clams are then placed in selected locations, sampled periodically and remeasured. Observations on spawning conditions, parasites, and overall condition of the clams are made on a monthly basis. Plankton samples are made periodically to determine spawning success and larval dispersion.

In addition to this sampling program, project personnel have contacted and plan to work closely with industry representatives to determine what effects hydraulic dredging operations may have on the habitat. Samples are taken prior to and after industrial dredging operations. Periodical samples of the dredged materials are made to determine composition of the shell being dredged. The New Orleans Shell Producers Association including representatives of Ayers Materials, Inc., Jahncke Service, Inc., Louisiana Co., Inc., and Radcliff Materials, Inc. have demonstrated a distinct interest in the clam project and have offered their services whenever necessary.

Since the project is new and sampling stations have not all been selected, it is presumptuous to reach any conclusions at this early date. However, from the limited sampling completed, a predominant size class of 30 mm to 45 mm is evident (Figure 1). The sizes of *Rangia* collected in the modified oyster dredge ranged from 22 mm to 69 mm with a mean of 39 mm. The mesh size of the modified oyster dredge probably prevented capture of clams smaller than 22 mm.

A representative portion (10%) of each sample are taken to the laboratory where microscopic examination of the gonads is required for sex determination. Of the clams sexed, approximately 60 percent were males and 40 percent were females. However, no sex trends can be recognized due to the small number of samples collected.

The average temperature during the sampling was 19.80° Centigrade with a range from 18.7° C to 21.5° C. The salinity range was from 6.2 parts per thousand ppt to 10.8 ppt. The average salinity was 8.1 ppt.

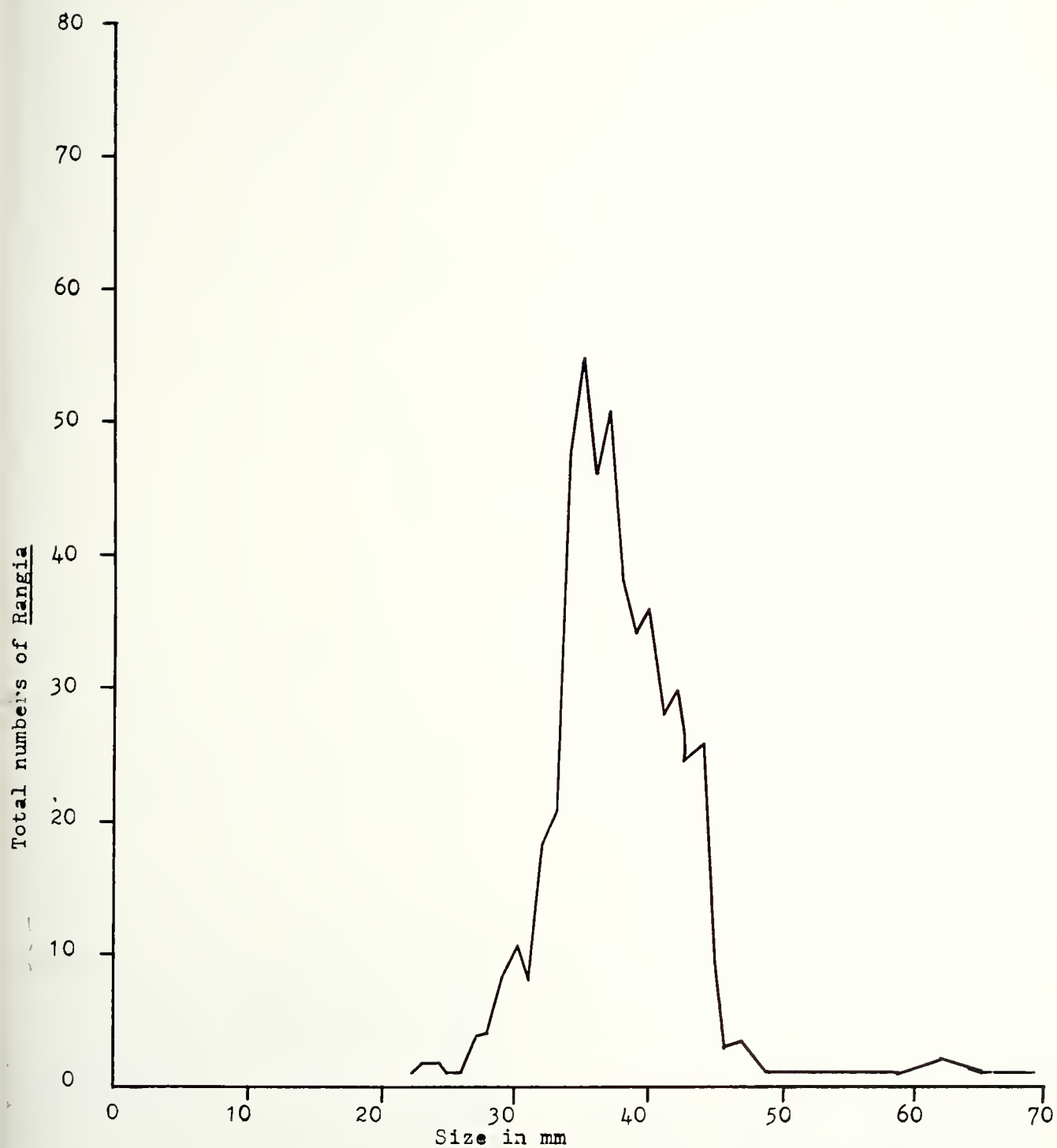


FIGURE 1. Size of population vs. size of individuals

## AREA I

### Shell Planting in St. Bernard Parish

**JOHNNY TARVER**

Study Leader

A clam shell plant in Three Mile Pass of St. Bernard Parish, Louisiana was made during November 8-16, 1969, for oyster bedding purposes. Ayers Materials, Inc. was awarded the contract resulting from their low bid and supplied the personnel, equipment, and materials. Louisiana Wild Life and Fisheries Commission personnel were present at all times and worked closely with Ayers employees to plant 14,800 cubic yards on approximately 446 superficial acres.



Planting clam shell for oyster cultch.

Eighteen barges were required for transportation of the shell. High pressure water hoses sprayed clam shell in approximately 30 feet transect over the entire plot in Three Mile Pass. Water depth in the shell plant location varied from five to eight feet. Air and water temperatures ranged from 18° to 22° C and 15° to 17° C respectively for the duration of the shell plant. The shells were dredged from Lake Maurepas and were of acceptable size since an average of 2.72 percent shake out resulted.

This shell plant was a very successful operation with only a day and a half interruption due to equipment malfunction and adverse weather conditions.

## AREA II

### Experiments to Re-establish Historical Oyster Seed Grounds and to Control the Southern Oyster Drill

**JUDD POLLARD**

Study Leader

Oyster culture in Louisiana is essentially a farming operation and helps account for present and future oyster production. Generally, seed

oysters are removed by dredging from the state-managed seed grounds east of the Mississippi River and transported to private leases on both sides of the river where the seed oysters are planted, cultivated and fattened before marketing.

The state-managed seed grounds lying east of the Mississippi River encompass approximately 450,000 acres. Salt water intrusion, steadily increasing over the past twenty years and accelerated by the Mississippi River-Gulf Outlet, has reduced the effectiveness of this area by some 60-65 percent. It is recognized that approximately 80 percent of Louisiana's oyster production between the Mississippi and Atchafalaya Rivers is dependent upon seed oysters obtained east of the Mississippi River.

On July 1, 1969, the Louisiana Wild Life and Fisheries Commission, acting through the Division of Oysters, Water Bottoms and Seafoods, embarked upon a program aimed at researching feasible methods of reclaiming these historical seed grounds which have become unproductive over the past quarter century. This program will deal also with the concomitant task of seeking practicable methods of controlling the Southern oyster drill.

The overall program, entitled "Experiments to Re-establish Historical Oyster Seed Grounds and to Control the Southern Oyster Drill," has many facets. Among these are (1) to execute and evaluate cultch plantings at experimental sites both historically productive but now reputedly unproductive and also at sites influenced by existing and proposed fresh water introductory control structures, (2) to evaluate various types of cultch material, (3) to evaluate various cultch planting methods, (4) to maintain a comprehensive system of monitoring hydrographic parameters throughout the area, (5) to delineate encroachment of the Southern oyster drill into areas historically unafflicted with this very destructive oyster predator, and (6) to conduct seasonal programs of monitoring planktonic forms of the American oyster and the Southern oyster drill.

## AREA II

### Black Bay Shell Plant

**JUDD POLLARD**

Study Leader

Federal funds provided as disaster assistance under Public Law 88-309, Section 4(b) enabled the Louisiana Wild Life and Fisheries Commission to take steps to assist in the recovery of hurricane Camille damaged Louisiana oyster fishery. These steps were the planting of clam shell cultch material at two locations in the estuaries of south-eastern Louisiana, Black Bay in Plaquemines Parish and Three-Mile Pass plant is covered in a separate report.

The Black Bay shell plant site was selected on October 14, after a joint inspection by Commission personnel and representatives of the Louisiana Oyster Growers and Dealers Association. The site itself is in an area of primarily very hard clay mud with little or no overburden of ooze or slush. On October 18, Ayers Materials, Inc., contractor for the plant, had men, material, and equipment on the site and proceeded to spread the clam shell cultch material. These shells were dredged in Lake Maurepas and were of a very satisfactory size. Undersize shell composed a negligible percentage of those sampled in a shaker from each barge load. Twenty barges were required to deliver slightly over 15,000 cubic yards of shell which were spread over 551 superficial acres. Louisiana Wild Life and Fisheries Commission personnel were present at all times during the spreading operations and worked closely with the Ayers personnel. Excellent cooperation throughout the operation was received from Ayers representatives and their field personnel.

The shell planting extended from October 18 through November 5. An alert for Hurricane Laurie forced a withdrawal of both Commission and contractor's personnel and equipment for several days; also, strong northeasterly winds hampered operations throughout the remainder of the period.

Preliminary underwater visual inspection of the plant by Commission divers indicated very acceptable coverage of the areas inspected. However, the strong winds and the resulting turbidity of the water forced postponement of this operation.

The area of this shell plant is closed to dredging and is well-marked to this effect. A Commission patrol boat is assigned to enforce this closure.



Clam shell being placed overboard to form reef for catching oyster spat.

## AREA III Commercial Fish Investigation

### WOODROW MOCK

Study Leader

Fishery products taken off the Gulf Coast of Louisiana have long contributed to the economy of the state. Industrial fish are a renewable natural resource, and as such, it is necessary that a better understanding be gained in order to protect and promote a continuous harvest. This concern has led to a project designated as "A Study of Commercially Important Estuarine Dependent Industrial Fishes." The objective of this study is to investigate the industrial fish populations of coastal Louisiana for the purpose of developing new management practices and to provide existing and new industry with information to best utilize these resources.

The major commercial fish taken off the coast of Louisiana is the menhaden, *Brevoortia patronus*. This species contributed over 600,000,000 pounds to the total fishery in Louisiana in 1968; this represented approximately \$8,000,000. Although this fish is utilized singularly, there are many other species that are of commercial value which are commonly referred to as "trash" fish. These "trash" fish are utilized as pet foods and to some extent (depending on the bulk of the species caught) as fish meal, fertilizer, meat for the fur animal growers, crab bait and oil extract.

Nearly all of the fish taken in the Gulf have one thing in common. They are dependent on estuarine waters for their early development. Because the estuaries are subject to constant change through the advance of industry, herein lies the greatest problem. Secondly, and almost of equal importance, is the nearly constant fishing effort applied to Gulf waters. Thirdly, is the fishing pressure applied to inland waters during open trawling season.

Some 38 species common to the Gulf coast are listed as commercially important by the Bureau of Commercial Fisheries. Those species caught in large numbers will be given careful attention for a possible fishery development.

Sampling of these organisms began at the passes into a bay system (plankton tows) and will continue year 'round. Sixteen foot trawl samples are made to capture sub-adult and adult specimens at selected permanent stations in inside waters. Salinity and water temperature are recorded with each sample. Species of commercial potential will be measured to determine growth while in inside waters. They will also be counted to determine population density and trends. It is further anticipated that through participating fishing industries information can be obtained concerning the offshore fishery catch.

An attempt will be made to correlate these fishery landings to organisms entering a bay and the sub-adults already there. The possibility of trawlers depleting the adult offshore spawning population of any one organism is remote at present. But, due to increasing utilization of fishery products and more refined methods of taking these fish, some regulation will probably be necessary in the future. If fishing effort for menhaden, for example, has to be seasonalized in certain areas until after they have spawned, other species may be utilized in other areas to offset the loss of that particular fish at that time. Spawning times of fish may be indicated by eggs and fish larvae taken in plankton tows.

Though the material for this study will be taken mainly from Barataria Bay area, information from fishing industry in other areas will be utilized whenever applicable.

#### AREA IV Blue Crab Study

**GERALD ADKINS**  
Study Leader

The blue crab supports the largest crab fishery in the United States. In 1960-62, it ranked fifth in value of landings in the United States. Louisiana contributed approximately \$500,000 to this valuable fishery. Information about the aspect of the seafood industry is needed so that a more thorough knowledge of the animal and its relationship to the industry may be determined. Such information is presently being accumulated in Louisiana by marine biologists of the Louisiana Wild Life and Fisheries Commission. This research is sponsored jointly by the federal and state governments on a cost-sharing basis, and is geared to gather such data as to be beneficial to both the state and industry.

The objectives of this study are:

- (1) to determine and evaluate the economic significance of the blue crab fishery in Louisiana;
- (2) to evaluate methods for taking blue crabs commercially; and
- (3) to determine environmental factors affecting annual blue crab production.

In addition to the above, commercial crab fishermen will be contacted to determine what types of gear is presently being used by the fishermen and the effectiveness of this gear. Certain types of improved experimental gear will be used to determine which type or types are most adaptable for the harvest of the blue crab.

The primary area in which the majority of the research will be done is composed of Terrebonne and Timbalier bays, Lake Pelto, and the intricate marshes northward of these bays. The study area consists of approximately 541,913 acres, with approximately 80 percent of the total area being water. This area is a large inland system of lakes,



Typical crab trap used by fishermen along the Louisiana Coast. The trap is rectangular, with a funnel leading toward the center from each side. The bait is placed in the smaller rectangle in the center of the trap. A plastic float connected by a line to the allows the fisherman to locate his traps.

bays, and bayous. It is bounded on the east by Bayou Lafourche, on the west by Bayou Sale, and on the south by the barrier islands, Timbalier and Last Island. It averages approximately 6 feet deep, and contains hundreds of small islands, reefs, and mud flats.

The areas around Lake Barre, Bay St. Elaine, and Caillou Island are very heavily exploited as oil producing areas and have countless pipe lines, oil wells, platforms, storage tanks, and access canals. The majority of the marsh surrounding the area is a salt to brackish marsh, with the salinities rarely dropping below 5 ppt. The vegetation is dominated by salt and brackish water types, which are characterized by having a high salt tolerance.

The study area is an area of high salt content, since there are no major bayous or associated streams discharging into the area. The area has an average yearly salinity of 15-20 ppt and an average yearly temperature of 18-24° Centigrade. A minimum temperature usually occurs in February and is around 5-8° C. The maximum temperature usually occurs in July or August, and is approximately 28-30° C. The lowest salinity is encountered after a heavy rainfall. The Houma Navigational Channel is the only major source of fresh water; this channel exerts the greatest influence on any rapid salinity changes in its discharge area. The Houma Navigational Channel seldom falls below 10 ppt. The other two major bayous emptying into the area, Bayou Petit Caillou and Bayou Terrebonne, rarely fall below 10 ppt at any time.

As the study progresses, much data will be gathered on the habits, habitats, growth, and movements of the blue crab. Some data has been analyzed pertaining to the unit effort of the 16 foot otter trawl, the average size crabs taken by this type of gear, and the sexual ratio of the blue crab. As more data is tabulated, much valuable information is expected to be gathered which will offer a better understanding of the blue crab. This information may then be applied by the proper authorities, using the proper procedures to manage this segment of our commercial seafood so that the maximum benefit to all concerned may be realized.

## AREA V & VI

### White and Brown Shrimp Study

WILSON GAIDRY AND CHARLES WHITE

Study Leaders

On July 1, 1969, a study was begun with specific aims to improve the understanding of the white shrimp, *Penaeus setiferus* and the brown shrimp, *P. aztecus*, and thus improve species management.

This program is studying factors that cause seasonal fluctuations and abundance in shrimp populations, with particular emphasis of study directed toward the effect of estuarine environmental conditions on the annual shrimp production.

Over a decade ago, the Louisiana Wild Life and Fisheries Commission began intensive research to aid a growing industry in marine fisheries. The marine lab at Grand Terre Island was built in 1960 to support the technical effort in marine research. Initial shrimp research was begun intensively in 1962, but it was not until 1965 that the study was expanded to other areas of the state. In 1965 a study began in the southwestern portion of Terrebonne Parish with the major emphasis placed on white shrimp. Study areas were established coastwide in 1966 under the 88-309 Federal Aid Projects. Under this project data was collected to support this study of white shrimp and brown shrimp.

Louisiana's estuarine areas constitute one of the major centers of commercial shrimp production which is between 60,000,000 to 80,000,000 pounds with a net value of approximately \$25,000,000. These estuaries serve as nursery grounds for these two most important shrimp species of the northern Gulf. Therefore, this intensive study is directed at providing the information necessary to the maintenance and continued annual production of this renewable natural resource.

The history of the white and brown shrimp fisheries in Louisiana is being reviewed in connection with this project. In the 1930's and 1940's, a large population of white shrimp existed east of the Mississippi River and contributed to large

and highly valued commercial fisheries in the Lake Pontchartrain to Chandeleur Island area; today, the population of white shrimp east of the river is very negligible. During this period of decline in production, there was no systematic program of study to investigate the cause of the loss of production; thus the necessary steps to avoid the loss of the fisheries could not be taken.

The present study program is divided into two approaches; one, broad on a coastwide basis, and one, intensive on an area basis. The broad coastwide approach will incorporate a sampling program to give a clear picture of the total production of the estuaries and also incorporate the monitoring of environmental conditions throughout the estuary. Under this program each area will submit to the Area V office in Houma weekly data concerning the shrimp population in the estuaries and the associated vital environmental factors. Under this system first hand information will be gathered to better direct and regulate the shrimp harvest. Past data will also be tabulated and correlated to provide a statistical approach which may enable anticipation in advance of the biological trends or learning the relationship of factors by mathematical computations.



This is the standard net used in sampling post-larval shrimp, crabs and fishes. Meter in center of net records the number of revolutions made during the sample, thus allowing the volume of water strained through the net to be calculated.

Each study area makes weekly samples with sixteen foot and six foot otter trawls and 1/2 meter plankton nets. Sampling efforts will be categorized by the four types of habitats: (1) the mouths of bayous and passes will be sampled on a weekly basis for post-larval white and brown shrimp with metered plankton collecting gear during late spring, summer and early autumn; (2) the shallow brackish inside areas bordered by marsh grasses will be sampled weekly for juvenile shrimp with six foot trawls and by a specialized trawl known descriptively as a "marsh net" during the spring and summer; (3) the relatively deeper bayous and bays comprising the inside fishing grounds will be sampled weekly for sub-adult shrimp with six and sixteen foot otter trawls during the late summer and throughout the autumn; and, (4) the saline offshore areas will be sampled by sixteen foot otter trawls periodically year round.

The locations at which the samples are made are unchanged from year to year and the sampling techniques are identical. Ten minute durations are the time periods of sampling units. The sampling areas are selected to represent the total biology of the area and allow as complete as possible a study. The data from the samples collected in each area is centralized and compiled, computed, formulated and analyzed to continually have up-to-date information necessary in the shrimp management.

This data is related to all pertinent environmental and statistical information to give better understanding of the species.

Distribution of shrimp in the estuaries is not uniform and is influenced by a number of factors in the environment; however, salinity, temperature and substrate are the principal determinants.

Generally, the inshore-offshore movement of shrimp is largely influenced by stages of development. Smaller shrimp are found in the shallow marsh ponds (nursery areas), as they grow, the shrimp progress to deeper lakes and bays, and finally, in a large sub-adult or adult stage, reach the open gulf.

As water temperature begins to cool in late fall, an offshore movement of shrimp occurs. By December the cold water temperature inshore has forced most of the shrimp offshore into the Gulf where temperatures are warmer. Many of these shrimp are forced offshore prematurely in the juvenile and early sub-adult stages, not having had sufficient time to complete their growth in the inshore nursery area.

These shrimp overwinter in the near offshore waters and grow very little until spring. This is due to cooler water temperatures; growth slows with low water temperatures and increase with higher water temperatures until the lethal point on either extreme is reached. It is vitally important to know more about the movement, mi-

grations, seasonal distribution and growth pattern of shrimp for better species management.

The present study will be directed toward the relationship of these environmental parameters to the population dynamics of the shrimp. The study will sample selectively a given population of shrimp as it leaves the inshore areas, overwinter offshore and then to possibly returning temporarily in the spring to the inshore areas.

An intensive sampling program coupled with continued monitoring of environmental conditions is being used to constantly track and observe the shrimp population. Particular emphasis will be placed on the overwintering population in near offshore waters.

## AREA VI Calcasieu Lake Experimental Oyster Tonging Reef

CHARLES WHITE  
Study Leader

During the early 1960's, Calcasieu Lake played a prominent part in the production of oysters along the Louisiana Coast, reaching a high of over 125,000 sacks. As late as 1963, this lake produced in excess of 30,000 sacks of oysters during the winter tonging season. The following season, 1964, only 3,000 sacks of oysters were produced. The reasons for the dramatic decline are many; but regardless, a decline of this magnitude had serious effect on the economy of the outlying fishing communities of this area.

In August, 1966, the Oyster Division established a Coastal Study Area, headquartered in Lake Charles. One of the functions of this newly created office was to formulate a research and management plan for the oyster resources of the southwest Louisiana coast. Special emphasis was given to Calcasieu Lake. Prior research programs along the eastern Louisiana Coast had shown the value of planting clam shell for oyster cultch. In May, 1967, several experimental clam shell plots were placed at various locations in Calcasieu Lake. The aim of this experiment was to evaluate the oyster setting potential of this area. Bi-weekly checks were made of the set results. Positive results were obtained at all locations.

The following year, 1968, virtually the same program was carried out. The results were positive. It became apparent that construction of large shell plants for the establishment of experimental oyster reefs was feasible. A review of the data obtained from the two previous years of research was valuable in determining what locations would be best suited for the proposed shell plants. This program actually consisted of three objectives:

1. To reestablish a suitable oyster population in Calcasieu Lake, through shell planting.

2. To construct each location in such a way as to lend its resources to future commercial use.
3. To create alternate areas parallel to the shell plants for the purpose of culling and cleaning the tonged oysters. This would aid in the expansion of the existing reefs and also prevent the smothering out of live oysters from culling activities.

Bids for the placement of shell was advertised in early spring, 1969. A contract was accepted. On May 2, 1969, the first of three pre-determined shell reef sites was surveyed and staked out. Each location measured 150 feet wide and 2,100 feet long or a surface area of 7.2 acres.

The actual placement of shell began on May 6, and concluded on May 19, 1969. A total of 12,-

448.23 cubic yards of clam shell was placed at the three reef locations.

Since completion, monthly checks have been made of the success of this shell plant. In addition records have been kept of the salinity and temperature ranges. Monthly samples were made of certain chemical levels of the surrounding waters. Measurements of trace metals were also conducted during past months.

A successful spat catch occurred at two of the shell plants during late October, 1969. There is an optimistic feeling that a spat set will occur at the third and final location.

With the success already at hand and the research and development plans underway for this area, a bright future is speculated for its oyster resources.

# Fur Division

**T**HE VALUE OF Louisiana's fur industry has increased significantly in the past few years. A good, relatively stable market has been developed for nutria.

Modern fashion has stimulated an interest in unusual furs and styles. Nutria, being a very versatile fur, has fit in well with this fashion trend. Unplucked fur is being used for moderately priced "fun furs." Since they require a minimum of dressing and processing, the cost of the finished product has been reduced accordingly. Another advantage in the use of unplucked fur is that better use can be made of the flatter, poorer grades. Only the top, densely furred skins have been used as plucked and sheared garments because this process substantially reduces the amount of hair in the finished product.

Muskrats are also being used in the manufacture of moderately priced casual or sport clothes. The cased skin is split open along the belly, trimmed and sewn together. The result is a beautiful mixture of dark, glossy back fur, contrasted with the rich, brown sides and silver bellies. More conventional coats utilizing muskrats and plucked and sheared nutria are also increasing in demand.

Aside from the market, fur production in the marshes has also increased. All species showed an increase in the 1968-69 season over the previous year, as evidenced by the accompanying tables and figure. There was an increase of 57.3 percent in nutria production, with 1,754,028 pelts taken, which represents the greatest number ever sold in Louisiana. Muskrat production increased 67.4 percent with a take of 1,556,764 skins. This is the first time in nearly a decade that over 1,000,000 muskrats were taken.

Prices paid for the furs were also up. Muskrats increased 35¢ per pelt; nutria, 25¢; mink, \$2.00; raccoon, \$1.00; and others, \$5.00. The total value for the pelts to the trappers was \$6,063,514.40.



**TED O'NEIL**  
Chief

## LOUISIANA FUR PRODUCTION

Table I

### 1967-68 Season

|                               |           |   |        |                |
|-------------------------------|-----------|---|--------|----------------|
| Muskrat .....                 | 929,964   | @ | \$ .75 | \$ 697,473.00  |
| Mink .....                    | 27,498    | @ | 3.00   | 82,494.00      |
| Raccoon .....                 | 50,790    | @ | 1.50   | 76,185.00      |
| Otter .....                   | 3,466     | @ | 14.00  | 48,524.00      |
| Nutria* .....                 | 1,115,410 | @ | 1.75   | 1,951,967.50   |
| Opossum .....                 | 3,009     | @ | .30    | 902.70         |
| Fox .....                     | 95        | @ | 2.00   | 190.00         |
| Skunk .....                   | 136       | @ | .70    | 95.20          |
| Lynx .....                    | 16        | @ | 3.00   | 48.00          |
| Beaver .....                  | 89        | @ | 5.00   | 445.00         |
| Total .....                   | 2,130,473 |   |        | \$2,858,324.40 |
| Nutria Meat<br>(lb) .....     | 9,000,000 | @ | 9¢     | 810,000.00     |
| Raccoon .....                 | 200,000   | @ | 20¢    | 40,000.00      |
| Opossum .....                 | 20,000    | @ | 20¢    | 4,000.00       |
| Total .....                   | 9,220,000 |   |        | \$ 854,000.00  |
| Total Meat<br>and Pelts ..... |           |   |        | \$3,712,324.40 |

\* Eastern Pelts—\$1.00; Western Pelts—\$2.25



A. W. Palmisano, Biologist with the Fur Division, shown here at work setting up a system of coastal-wide transects, whereby detail data may be collected annually or seasonally, making it possible to stay right on top of the causes and effects that may occur. Palmisano is a dedicated marsh ecologist with a dissertation for his doctorate on three-cornered grass (*Scirpus oleyi*), the food plant responsible for Louisiana's muskrat population.

#### 1968-69 Season

|                                   |                   |   |         |                       |
|-----------------------------------|-------------------|---|---------|-----------------------|
| Muskrat .....                     | 1,556,764         | @ | \$ 1.10 | \$1,712,440.40        |
| Nutria                            |                   |   |         |                       |
| (Eastern La.) ..                  | 1,000,000         | @ | 1.50    | 1,500,000.00          |
| (Western La.) ..                  | 754,028           | @ | 3.00    | 2,262,084.00          |
| Raccoon .....                     | 95,654            | @ | 2.50    | 239,135.00            |
| Mink .....                        | 46,918            | @ | 5.00    | 234,590.00            |
| Opossum .....                     | 9,496             | @ | .50     | 4,748.00              |
| Skunk .....                       | 250               | @ | .50     | 125.00                |
| Otter .....                       | 5,426             | @ | 20.00   | 108,520.00            |
| Lynx .....                        | 56                | @ | 5.00    | 280.00                |
| Fox .....                         | 324               | @ | 3.00    | 972.00                |
| Beaver .....                      | 124               | @ | 5.00    | 620.00                |
| <b>Total .....</b>                | <b>3,469,040</b>  |   |         | <b>\$6,063,514.40</b> |
| Nutria Meat                       |                   |   |         |                       |
| (lb) .....                        | 10,500,000        | @ | 9¢      | 945,000.00            |
| Muskrat .....                     | 700,000           | @ | 9¢      | 63,000.00             |
| Raccoon .....                     | 400,000           | @ | 20¢     | 80,000.00             |
| Opossum .....                     | 60,000            | @ | 20¢     | 12,000.00             |
| <b>Total .....</b>                | <b>11,660,000</b> |   |         | <b>\$1,100,000.00</b> |
| <b>Total Meat and Pelts .....</b> |                   |   |         | <b>\$7,163,514.40</b> |

#### INCREASE IN FUR PRODUCTION FROM 1967-68 TO 1968-69 TRAPPING SEASON

Table II

| <i>Furbearer</i> | <i>Pelt Increase</i> | <i>% Increase</i> |
|------------------|----------------------|-------------------|
| Nutria .....     | 638,618              | 57.3              |
| Muskrat .....    | 626,800              | 67.4              |
| Raccoon .....    | 44,864               | 88.3              |
| Mink .....       | 19,420               | 70.6              |
| Otter .....      | 1,960                | 56.9              |
| Opossum .....    | 6,487                | 215.6             |
| Fox .....        | 229                  | 241.1             |
| Beaver .....     | 35                   | 39.3              |
| Lynx .....       | 40                   | 250.0             |
| Skunk .....      | 114                  | 83.8              |

The Fur Division was instrumental in getting federal funds appropriated for the purchase of nutria meat for rearing screwworm larvae at Mission, Texas. These larvae are sterilized and

used to combat the screwworm problem, primarily in cattle and wildlife, in central and lower Texas. In 1968-69, approximately 7,000,000 lbs. of Louisiana nutria meat was purchased by this control program. An additional 3,500,000 lbs. were sold as feed to mink ranchers throughout the United States, bringing the total to 10,500,000 lbs. of nutria meat valued at \$945,000. Meat sales of raccoon, muskrat and opossum were valued at \$155,000. Louisiana's entire fur production for the 1968-69 season therefore reached \$7,163,514.40, or an increase of 93 percent over the previous season.

Much work is being done to eliminate the rigorous requirements of the Interstate Commerce Commission regarding transporting nutria meat, classified by them as a non-agricultural commodity. Nutria is a wild animal, synonymous with the wild jack rabbit, which is exempt from these regulations. It is difficult to understand failure to facilitate transportation when the two situations are practically identical.

## ORIGIN AND DEVELOPMENT OF THE COASTAL MARSHES

The intelligent management of our coastal marshes requires an understanding of the processes responsible for their formation and disintegration.

The Mississippi River has had a profound effect on the geomorphology of the recent deposits of coastal Louisiana. This entire area is the product of sediment deposition following the rise of sea level 3,000 to 4,000 years ago. The Louisiana coastline has prograded 20 to 50 miles since that time forming the present day coastal plain. This plain is divided into two types based on the sedimentary processes responsible for their formation.

The Deltaic-Plain was formed by the direct deltaic deposition of the Mississippi River system. In the past 5,000 years, this system has shifted positional centers a number of times. The oldest system, the Maringouin-Mississippi, is presently overlain by more recent deposits of the Teche-Mississippi Delta which was active about 3,800 years ago. This system was responsible for the formation of many of the surface features observable in the western part of the Deltaic-Plain in the vicinity of Bayou Teche, which was a major distributary of the system. The river's course changed to a more easterly direction about 2,800 years ago, discharging sediment into the St. Bernard Delta in St. Bernard Parish. This delta extended into the Gulf of Mexico as far as the Chandeleur Islands. Subsequent subsidence and shoreline erosion has left these islands stranded 25 miles offshore.

Some 1,500 years ago, the river swung westward again, forming the Lafourche Delta. This system partially covered the older Teche-Missis-

sippi deposits and is responsible for much of the topographic relief in Lafourche and Terrebonne Parishes. Once again the river shifted to a more easterly direction, forming the Plaquemine Delta about 1,200 years ago. This delta was extended further seaward about 450 years ago, forming the present day Birdfoot Delta.

Landforms in the Deltaic-Plain are directly related to deltaic processes. Natural levees of distributaries of the old river channels and crevasses are the only sources of relief in much of this area. Boat traffic in the numerous distributary systems has been largely replaced by highways constructed to take advantage of the slightly elevated levees.

Interdistributary troughs lie between the arms of the distributary channels. In the past, when the distributaries breached their banks, fine silts



Musk rats are again chewing away at our coastal lowlands. Just imagine what a liability 6,000,000 to 8,000,000 muskrats would be if it were not for their value as a furbearer.

and clays were carried into these troughs forming swamps and marshlands. As long as the distributary was active, fresh water entered these systems and new deposits were laid down. This resulted in the formation of extensive fresh marshes and swamplands. Following the abandonment of the old channel, these areas continued to subside, allowing the encroachment of saline water from the Gulf of Mexico into the marshes. The marshes became progressively more saline and were eventually broken up into bays and tidal inlets. Subsidence is a major feature of the geomorphology of the Deltaic-Plain, but

plays a relatively minor role in the development of the Chenier Plain farther to the west.

The fundamental difference between the Chenier Plain and Deltaic-Plain is the conditions under which the deposits were laid down. As mentioned, the Deltaic-Plain resulted from direct deposition by the Mississippi River. The Chenier Plain developed as a result of deposition by the prevailing westerly longshore currents of the Gulf of Mexico. The Mississippi River was the source of the sediments, but they were carried into the Gulf of Mexico and deposited as mudflats along the coasts of Vermilion and Cameron Parishes. As mudflats built seaward, they were capped by marsh vegetation. This vegetation stabilized the flats and aided in sediment deposition. Marsh capped mudflat formations prograded as long as a sediment supply was furnished by the Mississippi River.

Several times in the past 3,000 years, the river has shifted depositional centers from east

to west. During periods of westerly discharge, more sediment was available to build out the Chenier Plain. It was during these periods that the shoreline advanced rapidly seaward forming extensive brackish and saline marshes. As the Mississippi River shifted to the east, the sediment supply diminished and shoreline accretion slowed or halted completely. Wave action encroached on the newly formed marsh; the shoreline began to retreat. Finer silts and clays were sorted from the sand and shell fragments forming beaches overlying the marsh deposits. The beaches continued to develop and move shoreward as long as sediment supply was insufficient to allow progradation. The size of the beaches formed was a function of the energy regime, the supply of sand and shell fragments available and the duration of time the Gulf encroached landward. Some of the beaches are nearly a mile across and 8 to 10 feet high.



Typical of the hundreds of abandoned Mississippi River Distributaries that finger out into the rapidly subsiding and eroding subdelta marshes of Southeast Louisiana. The nutritional value of the vegetation in the broken peat marshes at upper right is abnormally low due to lack of substance from river overflows.

Table III

## MUSKRAT NESTS PER MILE OF CENSUS LINE

| General Location                 | Hydro-<br>logic<br>Unit | Marsh Type     |                 |                   |               | Total<br>Avg. Nest<br>Per Mile |
|----------------------------------|-------------------------|----------------|-----------------|-------------------|---------------|--------------------------------|
|                                  |                         | Saline         | Brackish        | Inter-<br>mediate | Fresh         |                                |
| Lake Borgne .....                | 1                       | 0<br>(3.3) *   | .06<br>(15.4)   | .34<br>(2.9)      | 0<br>(0)      | .09<br>(21.6)                  |
| Lake Lery .....                  | 2                       | 0<br>(1.4)     | 18.37<br>(12.9) | 0<br>(0)          | 0<br>(0)      | 16.57<br>(14.3)                |
| Mississippi River Delta .....    | 3                       | 0<br>(0)       | 0<br>(0)        | .91<br>(3.3)      | .10<br>(9.8)  | .34<br>(13.1)                  |
| Barataria Bay .....              | 4                       | 4.24<br>(17.7) | 6.37<br>(19.0)  | 1.54<br>(2.6)     | .74<br>(25.8) | 3.36<br>(65.1)                 |
| Terrebonne .....                 | 5                       | 6.19<br>(26.8) | 12.20<br>(29.6) | 2.22<br>(3.6)     | .43<br>(29.9) | 6.10<br>(89.9)                 |
| Atchafalaya Bay .....            | 6                       | 0<br>(0)       | 0<br>(0)        | 0<br>(0)          | 0<br>(6.3)    | 0<br>(6.3)                     |
| Vermilion Bay .....              | 7                       | 0<br>(.1)      | 4.44<br>(37.6)  | 1.10<br>(17.2)    | 0<br>(5.4)    | 3.08<br>(60.3)                 |
| Grand Lake-White Lake .....      | 8                       | 0<br>(4.8)     | 1.42<br>(19.7)  | .64<br>(26.5)     | .13<br>(54.0) | .50<br>(105.0)                 |
| Sabine Lake-Calcasieu Lake ..... | 9                       | 0<br>(.9)      | 2.25<br>(28.5)  | .59<br>(40.5)     | 0<br>(7.9)    | 1.13<br>(77.8)                 |
| Total average nest per mi. ....  |                         | 4.38**         | 6.02***         | .79               | .29           | 2.95                           |
| Total miles censused .....       |                         | (55.0)         | (162.7)         | (96.6)            | (139.1)       | (453.4)                        |

\* Numbers in parentheses are actual miles censused.

\*\* Houses in saline marsh average only 1 or 2 trappable muskrats per house.

\*\*\* Houses in good brackish marsh average 4 to 5 trappable muskrats per house.

Table IV

## LOUISIANA COASTAL AREA MARSH VEGETATIVE TYPES\* (Acres)

| Parish                           | Saline  | Fresh     | Brackish  | Intermediate | Total     |
|----------------------------------|---------|-----------|-----------|--------------|-----------|
| Cameron .....                    | 35,200  | 206,250   | 241,422   | 209,441      | 692,313   |
| Calcasieu .....                  |         | 3,692     | 4,677     | 16,492       | 24,861    |
| St. Mary .....                   |         | 87,877    | 25,108    | 28,308       | 141,293   |
| Vermilion .....                  | 10,338  | 154,230   | 97,469    | 92,308       | 354,345   |
| Iberia .....                     | 1,969   | 2,708     | 95,262    | 22,154       | 122,093   |
| Terrebonne .....                 | 272,246 | 272,246   | 193,477   | 43,077       | 781,046   |
| Lafourche .....                  | 110,769 | 200,123   | 139,077   | 32,492       | 482,461   |
| St. Charles .....                |         | 86,892    |           | 5,415        | 92,307    |
| Jefferson .....                  | 15,262  | 32,000    | 65,969    | 28,800       | 142,031   |
| St. John the Baptist .....       |         | 25,600    |           |              | 25,600    |
| Plaquemines .....                | 184,684 | 142,277   | 122,246   | 145,723      | 594,930   |
| St. Bernard .....                | 168,169 |           | 134,480   | 15,754       | 318,403   |
| Orleans .....                    |         |           | 49,230    |              | 49,230    |
| St. Tammany .....                |         | 7,631     | 17,723    | 11,815       | 37,169    |
| Totals .....                     | 798,637 | 1,221,526 | 1,186,140 | 651,779      | 3,858,082 |
| Hydrological Unit                | Saline  | Fresh     | Brackish  | Intermediate | Total     |
| Lake Borgne .....                | 18,215  | 16,000    | 177,481   | 148,626      | 360,321   |
| Lake Lery .....                  | 20,677  | 343,249   | 90,272    | 107,584      | 627,677   |
| Mississippi River Delta .....    | 8,615   | 31,508    | 196,185   | 112,493      | 348,801   |
| Barataria Bay .....              |         | 64,000    |           |              | 64,000    |
| Terrebonne .....                 | 311,138 | 355,446   | 224,985   | 49,231       | 940,800   |
| Atchafalaya Bay .....            | 204,277 | 269,784   | 231,876   | 66,215       | 772,152   |
| Vermilion Bay .....              | 6,284   | 129,231   | 23,385    | 107,569      | 266,470   |
| Grand Lake-White Lake .....      | 61,262  |           | 60,954    | 27,077       | 149,293   |
| Sabine Lake-Calcasieu Lake ..... | 168,169 | 12,308    | 181,002   | 32,984       | 394,463   |
| Totals .....                     | 798,637 | 1,221,526 | 1,186,140 | 651,779      | 3,858,082 |

\* Based on Vegetative Type Map of the Louisiana Coastal Marshes, by Chabreck, Joanen, and Palmisano, August, 1968.

Sediment supply available to the littoral currents increased as the Mississippi River shifted to a more westerly direction. Once again marsh-capped mudflats built seaward, leaving the recently formed beach stranded and surrounded by marsh. These stranded beaches are called cheniers and are a characteristic feature of the Chenier Plain. The oldest cheniers formed about 2,800 years ago when the Teche-Mississippi shifted eastward forming the St. Bernard Delta. This stranded beach ridge lies nearly 10 miles inland from the present day shoreline.

Unfortunately, at the present time destructive geological processes predominate over constructive processes. The Mississippi River has prograded almost to the Continental Shelf. As a result of levees and channelization, fresh water and sediments are being discharged into deep water off the mouths of major river distributaries. The high salinity of the Gulf quickly neutralizes the effect of the fresh water, and most of the rich sediment is lost off the Continental Shelf. Subsidence and shore erosion are destroying saline and brackish marshes at a rate of one to two percent per year in the Deltaic-Plain. Salt marshes have advanced inland one to two miles in the past 20 years at the expense of the productive brackish marshes.

(Source: Geological information taken from work conducted at L.S.U. by Dr. J. P. Morgan, Dr. Henry V. Howe, and Dr. R. J. Russell)

## MANAGEMENT

As in the past, marsh management for muskrats should be directed towards creating conditions for the optimum production of three-cornered grass (*Scirpus olneyi*). Over 10 muskrats per acre have been trapped for several consecutive peak years in this type of marsh. In good years, 80 percent of the total muskrat catch is taken in three-cornered marshes. The conditions under which this plant develops are apparently ideal for muskrat production. Salinity should range between 2 and 20 parts per thousand. Water levels should be maintained between -2 and +2 inches, but should not be allowed to drop below -4 inches. Muskrats also require a well developed peat or root system to maintain their tunnels and runs. However, even if these ideal conditions are created and maintained, there is no assurance that a three-cornered marsh will develop. Wiregrass (*Spartina patens*) grows well under the same edaphic conditions but is poor muskrat producing marsh. Three-cornered grass grows at a much faster rate than wiregrass. If competition from animals is reduced by heavy trapping, and competition from undesirable plants is reduced by burning, a productive three-cornered grass marsh can develop. Fall burning followed immediately by flooding with several

inches of water reduces the growth of wiregrass and encourages three-square development.

Nutria appear to do well in almost any type of marsh. Fresh marshes with fast growing plants such as alligator weed (*Alternanthera philoxeroides*) and tall grass cover are the most highly productive in nutria. When one attempts to develop a three-cornered grass marsh, this furbearer should be trapped very heavily. Nutria wander much more than muskrats and will seek out and destroy small pockets of three-square before it has a chance to develop. Once a productive marsh is created, intensive trapping is required to maintain the animal population within the carrying capacity of their range.

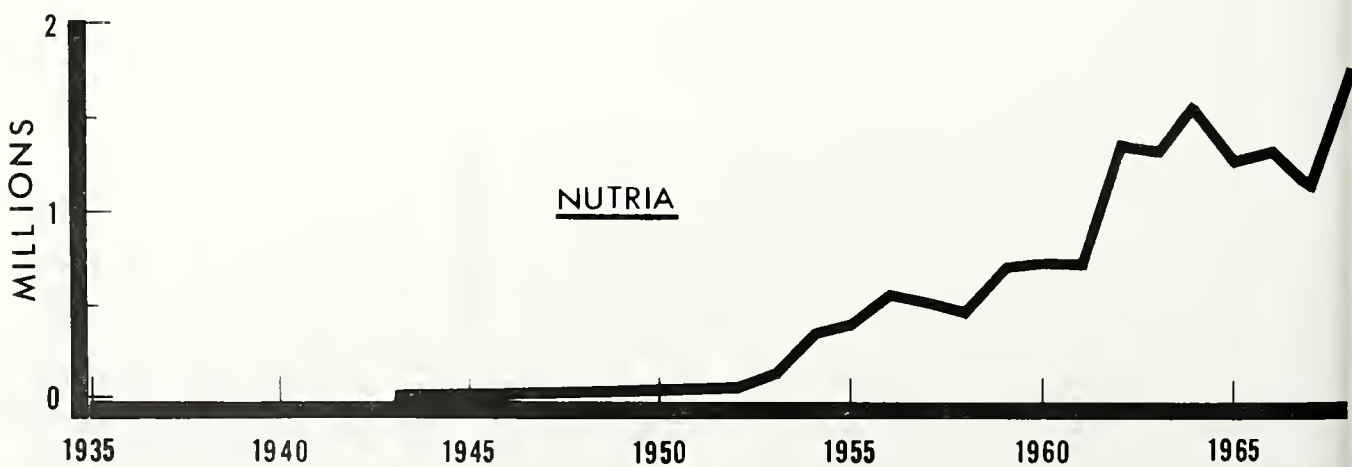
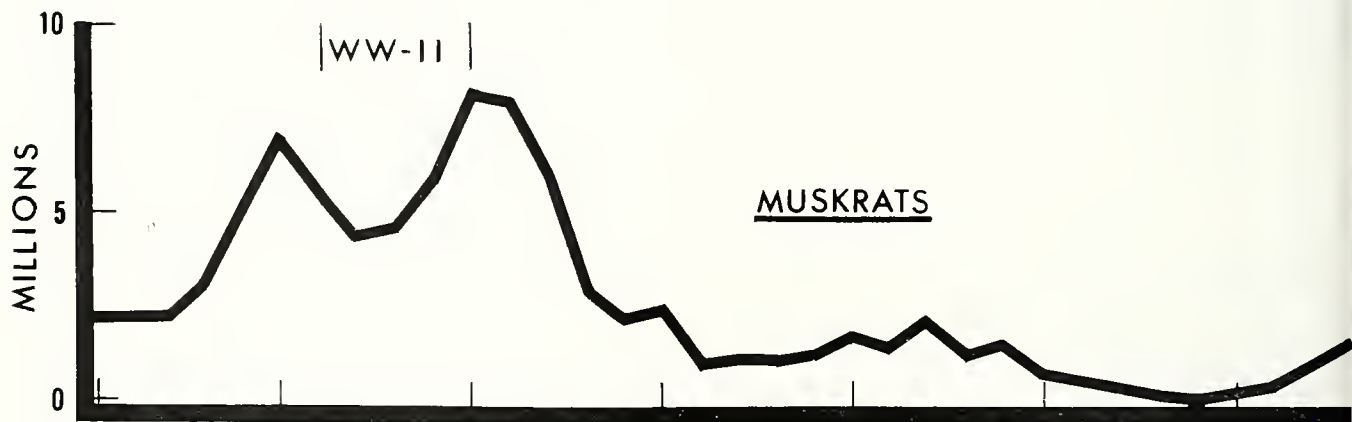
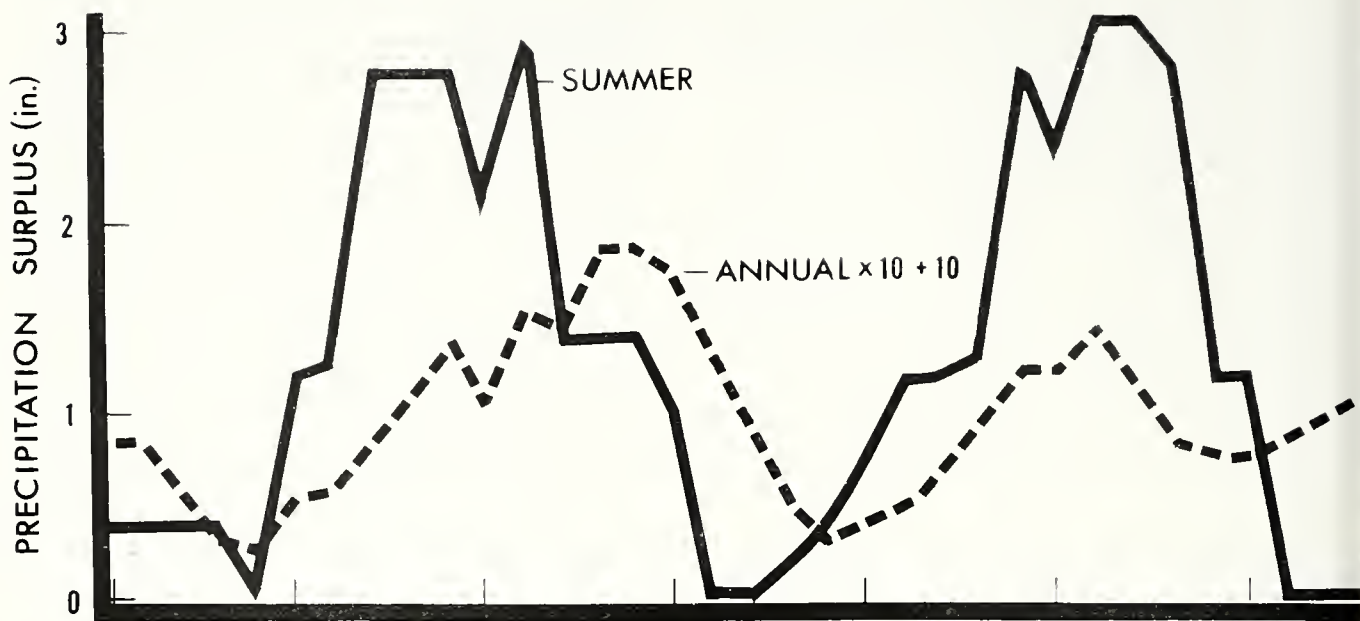
The most productive areas of coastal marsh are intermediate zones where salinity is not too high to restrict growth, and yet available nutrients are in high enough concentrations to allow good growth. These moderately saline marshes are in the greatest danger of being destroyed by salt water intrusion and industrial activities.

Breaks in the Mississippi River levee in 1922, and again in 1927, dumped huge quantities of fresh water and sediment into the marshes of St. Bernard and Plaquemines Parishes. Muskrat trapping was excellent for several reasons following these floods. One, the nutrients and sediment fertilized the exhausted marsh soils. These floods also practically eliminated the animal populations in the marsh, allowing desirable plants to develop free of competition from herbivores. Carnivorous predators—mink, raccoon and otter—were reduced and took longer to recover than the prolific rodents.

The use of small siphons east of the Mississippi River have shown some promise of rejuvenating the marshes, but in order to significantly affect the overall fur catch, these projects must be undertaken on a much greater scale. All management practices should be followed closely to evaluate their effectiveness and to detect any detrimental effects on other interests.

## BASIC STUDIES TO DETERMINE LOUISIANA'S FUTURE WATER NEEDS

Since May, 1968, the Fur Division has participated in an extensive survey of the wildlife, vegetation, water and soils of coastal Louisiana. This Division is in charge of the Commercial Wildlife Section of the all encompassing survey being carried out in conjunction with the U.S. Corps of Engineers, U.S. Fish & Wildlife Service and Gulf South Research Institute. A study is being conducted to determine the water needs of this area for optimum wildlife production. A vegetative type map has been prepared in cooperation with the Refuge Division and the L.S.U. Cooperative Wildlife Research Unit per-



sonnel. Preliminary comparisons of this map with the map produced by Ted O'Neil in 1949 show surprisingly little overall vegetation change. Saw-grass (*Cladium jamaicense*), which formed a very extensive plant community in Southwest Louisiana, died out and was replaced by alligator weed, bull-tongue (*Sagittaria falcata*) and wild millet (*Echinochloa walteri*). The productive brackish marshes retreated inland one or two miles in Southeast Louisiana, but the overall acreage has remained essentially the same, approximately 1,000,000 acres.

Hundreds of soil and water samples were collected at the time of the vegetation survey. They are presently being analyzed, and when completed will give an excellent picture of the inter-relationships of wildlife, plant communities, soil fertility and water quality in coastal Louisiana.

### MUSKRAT AND NUTRIA DIE-OFF OCCUR WITH OVERPOPULATION

Visits were made to several areas to check reports of nutria and muskrat die-offs. In a fresh marsh area of approximately 2,000 to 3,000 acres, nutria had completely destroyed the marsh vegetation. At their peak during the late summer, there were approximately 4 to 5 animals per acre of marsh. Drought, combined with high temperature and an early frost, produced a stagnant condition in the marsh. Mottled ducks began to die in August and September, and by October, the nutria began dying. By mid November, approximately 60 percent to 80 percent of the nutria were affected, and hundreds of ducks had died. Specimens of sick nutria and ducks were collected on November 19 and again on December 5, and sent to Tulane Medical School and Bear River Research Station in Utah.

All ducks examined had botulism toxin in their blood. This is a soil bacteria that grows under stagnant conditions and produces a toxin in the mud and water; birds pick up the toxin when they feed and drink. The toxin is broken down however by heat when cooked, leaving no toxin. Fourteen nutria examined showed no signs of botulism. They had no significant intestinal or blood parasites; stomachs contained food; and there was fat tissue present. Salinities in the marsh were low, ranging from 1.04 to 1.71 parts

per thousand. Laboratory tests are still being conducted, but preliminary results indicate that some toxin, possibly in their food or the soil, was responsible for the die-off.

Muskrat die-offs reported north of Lake Pontchartrain were investigated. The animals were again overpopulated and had eaten the marsh into a soupy muck. The stagnant conditions which followed were probably responsible for the die-off.

The solution to this problem in fur animals is the prevention of overpopulation, resulting in habitat destruction. Land managers should insist on heavy, uniform harvest of both nutria and muskrats. If pockets of muskrat and nutria remain unharvested, they can reproduce and destroy the marsh by the following trapping season. Once a die-off has begun, little can be done to save the remaining animals.

### FUR PROMOTIONAL PROGRAMS

The Fur Division participated with the Louisiana Department of Agriculture in seven television shows of a fashion type. Garments created from nutria and muskrat were used to promote the Louisiana furs, in both men's and women's attire. The Agriculture Commission feels that it is to their advantage to keep trapping alive, both from the standpoint of preventing crop depredation, and to lend added income to the farmer during his off season.

The Louisiana Fur & Wildlife Festival held recently in Cameron lent a great deal to the promotion of Louisiana furs. This organization is always hard pressed for financial support, and it was grateful at receiving contributions from the fur dealers, buyers and equipment suppliers, with an interest in seeing that the Fur Queen and the runners-up were properly attired in Louisiana fur pieces.

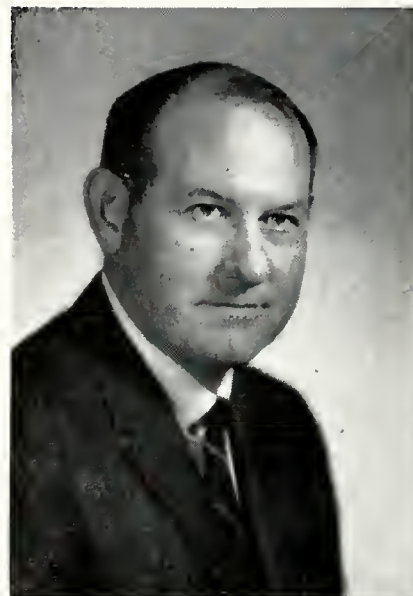
More encouraging than the present value of the fur industry is its upward trend. The period of instability which occurred in the past 10 to 15 years is apparently leveling off. When conditions are right, the muskrat can reproduce at a fantastic rate. They appear to be recovering from the low populations of the mid 1960's, and may challenge nutria for leadership of Louisiana's fur industry in the not too distant future.

# Refuge Division

**D**URING THE PAST TWO YEARS the Refuge Division has been actively engaged in programs dealing with the management of some 300,000 acres of land for the improvement of both fish and wildlife. These marsh lands make up some of the most productive waterfowl areas that can be found on the North American Continent. However, maintaining these areas in a manner capable of carrying the tremendous concentration of waterfowl is a very costly, time consuming, and tedious task.

The two basic management practices used in these areas were the impoundment system and the installation of Wakefield weirs in the drainage system. These management practices have proven very successful in the past and the use of these management practices are largely dependent upon marsh soil types. In areas which can support a continuous levee an impoundment system was used. These impoundments are leveed off areas ranging in size from 400 acres up to 8,000 acres with water control structures strategically placed in the levee system in order to provide a means of controlling water levels for the desired emergent or aquatic plants. In the past a crank type radial gate system was used in all the impoundments. However, these gates have proven to be ineffective in controlling water levels during periods of excessive rainfall. Two new systems of controlling water levels have been installed in the impoundments during the past two years on Rockefeller Refuge. A system of stop log structures have been installed in three brackish water impoundments. Management here has been directed toward the production of aquatic plants such as widgeon grass and spike rush. In the more fresher and intermediate marsh types three pumping units have been installed where alternating water levels are a must each year for the production of desirable emergent waterfowl food plants such as millet, foxtail and Cyperus.

The installation of Wakefield weirs have proven to be a very desirable management practice in



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Chief

areas which cannot support a continuous levee system. This type of management is considerably less expensive as compared to the impoundment system. These structures are low sill dams constructed in the tidal drainage system and set six inches below marsh level. These weirs stabilize water conditions in the marsh ponds and pot-holes behind the structures. By stabilizing water levels, turbidity and tidal fluctuations were reduced thus creating ideal conditions for the production of aquatic plants which are utilized in quantity by waterfowl. Also, the weirs have proven favorable for the production of various forms of marine life.

Management practices in all the refuges have been directed towards enhancing the marshes for waterfowl. Because of its unique location, Louisiana coastal marshes are some of the most important waterfowl areas in the United States. Louisiana's position at the southern end of the Mississippi Flyway causes the state to serve as the wintering home for many of the waterfowl from northern nesting grounds. The refuges play host to several million ducks, geese, coots, and numerous wading birds each year. Also these refuges play an important role as resting areas for many of the transient birds that winter in Central and South America.

The Rockefeller, Marsh Island and State Wildlife Refuges were received through gifts of donations whereby rigid terms and stipulations were laid down under which the areas were to be perpetuated. The St. Tammany Refuge, Pointe-au-Chien, and Salvador Wildlife Management Areas were acquired by outright land purchases. The Pass-a-Loutre Waterfowl Management Area was set aside by an act of the 1921 Legislature, and



Aerial view of the headquarters site of Rockefeller Refuge showing workshop, office, General Quarters, three residences, the wildlife display area, and in the foreground the goose nesting pasture.

the Coulee Refuge, the only inland refuge of the division, is a privately owned tract of land which is leased to the Commission.

These state owned lands are extremely important to the State of Louisiana not only from the revenue derived from the mineral development but also provide areas where research can be carried on undisturbed and uninterrupted. The findings gained from these various projects have proved to be a valuable asset in planning management practices for the various refuges. Also, these findings have been published in technical journals and circulars with international distributions.

A cooperative research agreement has been entered into by the Refuge Division and the Louisiana State Cooperative Wildlife and Fisheries Units housed at Louisiana State University. The refuge division provides financial assistance in the form of grants and equipment as well as housing on the various refuges. The Research Units in turn provide competent research personnel to study various marsh management problems concurrent with the refuge management programs. Technical personnel of the Refuge Division provide administrative assistance and technical advice on many of the research projects.

In addition to the importance of the refuge as a wintering area for ducks and geese these areas provide the last remaining stronghold for the American alligator. The alligator has been exploited in much of its original range and today is found in good numbers only on refuges and privately owned tracts of land which afford these reptiles the necessary protection.

The decline in alligator populations has been brought about by the increased demand for alligator products. The season has been closed to the killing of alligator in Louisiana since 1963. However, the high price paid for illegal hides has attracted poachers and necessitates extensive patrol activities during the warmer months in the coastal areas.

Very little is known about the general life history of the alligator and before definite plans can be formulated for the management of this reptile numerous problems must be solved concerning the management implication of this animal.

The Refuge Division initiated a general life history study on the alligator, and during the past two years one of the nation's most accelerated alligator research programs has been conducted on Rockefeller Refuge.

Public waterfowl hunting is an important phase of the Division's management program and is conducted each year on Pass-a-Loutre and on the two newly acquired tracts of land, Salvador and Pointe-au-Chien Wildlife Management Areas. These two tracts of land totaling some 56,000 acres were purchased in 1968 from monies obtained from the conservation fund whose main source of revenue is derived from the sale of hunting and fishing licenses and mineral income from the Pass-a-Loutre Waterfowl Management Area.

The hurricane of August 1969 struck southeastern Louisiana's coast and brought with it devastating winds and high tides. As a result of this hurricane all of the existing camps, storage sheds, boat sheds, and equipment at Pass-a-

Loutre was either severely damaged or totally destroyed. Eight of the nine public hunting camps were lost and the main camp complex was totally annihilated. Wildlife of all forms were killed by the untold thousands. The carcasses of deer, nutria, muskrat, alligators, fish and cattle were present on pass banks and large floating islands of debris served as grim reminders of the 200 mile an hour winds which struck this area. However, a small number of these wildlife species remain and in time will repopulate these areas.

Probably the greatest loss which occurred to the lower delta, and which will take nature many years to re-establish, was the loss of the floating land masses. These floats formed through the years by a complex of silt deposition and floating aquatic plants. After many years of silt deposition and recurring emergent plant growth a media was created which was stable enough to support tree growth. These matted floats provided habitat for the various wildlife forms on the lower delta. As a result of the hurricane winds and high water the floats were broken apart by wind and wave action and washed out into the gulf.

A trapping program has been conducted on all refuges and waterfowl management areas with nutria being the prime fur bearer. Muskrat populations continue to remain low, however, on some areas muskrat have made a substantial comeback. Increased trapping efforts were made in these areas in order to keep this wildlife population under control.

An intensive marsh burning program has been underway on all coastal refuges in order to encourage the establishment of desirable food producing plants. This program usually begins in October of each year and continues until February, and is done to encourage three cornered grass, the preferred blue and snow goose food.

During the past two years the development of the numerous mineral leases continue to be a constant problem. Routine surveillance was maintained by refuge personnel during all drilling operation in order that pollution may be kept to a minimum.

The general approach by most mineral operations along the Louisiana coast in reaching a drilling site has been the excavation of a floatation canal 60 to 80 feet wide and approximately 8 feet deep. Such canals permit the drilling rig and other heavy equipment to be floated to the drilling site. This method of development has caused numerous problems involving drainage, erosion, salt water intrusion, and constant pollution. These conditions cause a reduction in habitat and the overall quality of the marshes are lowered.

An alternate plan for reaching a drilling site is through the construction of a roadway system. This method, although more expensive than the

canal system, has been employed on Rockefeller and Marsh Island refuges during the past several years. This relatively new method has proven very successful and has almost eliminated most problems associated with the canal system. Right of ways are carefully selected by personnel of the division and rigid stipulations have been included in all new mineral leases regarding pollution. A thorough inspection by refuge personnel is made of the drilling site in order to see that all phases of this contract are strictly adhered to.

In areas where roadways are impractical every effort is made to follow the natural water course to prevent the network of canals which has proven extremely detrimental to the marshes.

During the past two years every effort has been made to coordinate the mineral development program with the wildlife program. Each year a further refinement of the various methods used in developing mineral leases have been implemented by the oil companies on the different refuges and perhaps someday wildlife programs may benefit from these activities rather than be hampered.

The coastal marsh refuges are some of the most highly developed marshes on the North American Continent, and it is the intention of this division to continue this management program in such a manner as to perpetuate and develop these areas to their fullest potential.

## ROCKEFELLER WILDLIFE REFUGE

NED W. CRAIN

Refuge Supervisor

### Pumping Units

Plans and specifications were prepared by the Department of Public Works for pumping units in Lake 8, Lake 13 and Lake 14 on Rockefeller Refuge. The new pumping units were to be constructed in such a manner that the same unit could be used to either drain or fill the impoundments. The contract was awarded for constructing the pumping units in June, 1967. All units were completed and ready for use by the spring of 1969. Original plans for the management of these impoundments called for gravity type drainage. However, in years of excessive rainfall it was found that this gravity system was inadequate for the production of such annual grasses as wild millet, sprangletop, Cyperus, and fall panicum. With the installation of these pumping units in several of the more important impoundments exact water levels could be maintained and control could be gained as needed for the production of these grasses on an annual basis. A system of ditches was cut in each impoundment in order to facilitate the drainage of these management units. Pumping of these impoundments began in May, 1969. The impoundments were



**Construction of pumping units has been essential in managing water levels and influencing the production of desirable wildlife food plants in Rockefeller's large impoundments.**

dried by mid-June, 1969, however, it was necessary to continue pumping throughout the months of July and August in order to remove intermittent rainfall. Attempts were made to flood the impoundments in mid-September, 1969, however, with the extreme drought that prevailed in Southwest Louisiana during that time, it was noted that the salinity in the canals was too high and pumping could not commence until late November. The impoundments were re-flooded in December by a system of stop-log structures and pumping units. Water levels will be maintained and pumping will commence in May, 1970. This cycle will be repeated annually.

An additional pumping unit was constructed in Lake 1 by refuge personnel. This pumping unit was installed on the south levee of Lake 1. This is a one thousand acre impoundment and in the future will be managed for annual grasses such as millet, fall panicum, foxtail, *Cyperus*, etc. With the installation of the pumping unit in Lake 1, a total of approximately 7,000 acres of Rockefeller Refuge has been brought under the pumping system.

The corrugated metal culverts which were originally used as water control structures in these impoundments were all removed by refuge draglines and personnel. The majority of these gated corrugated metal culverts were found to be leaking and inoperative; however, some structures were repaired, returned to the shop at Rockefeller Refuge, and plans were formulated to use these structures in other areas whenever feasible.

### **Equipment and Building Maintenance**

Because of the number of projects undertaken on Rockefeller Refuge and the size of the development program on the area, a large amount of

equipment must be kept on hand. In the coastal areas such as on the refuge, equipment deteriorates much more rapidly than on other areas and as a result frequent inspections and maintenance are required. Most equipment was maintained through shop facilities on Rockefeller Refuge. The refuge is staffed with maintenance men and a shop foreman whose duties are to perform routine maintenance work on all equipment such as boats, marshbuggies, engines, tractors, etc. Major repair work on equipment is frequently done through authorized dealers and the equipment taken elsewhere for repair.

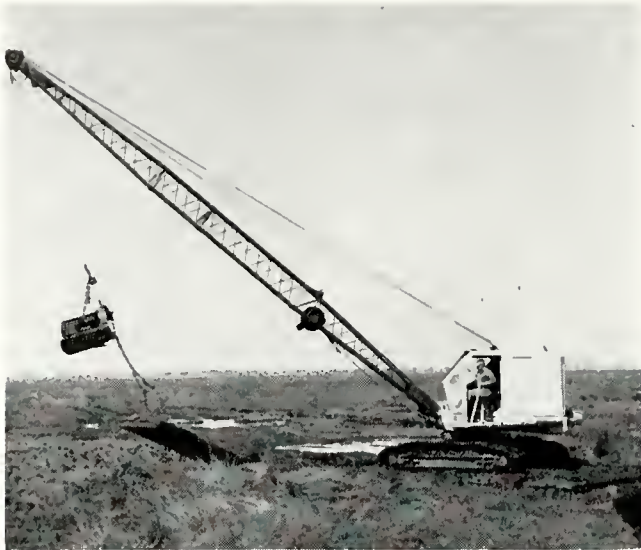
Maintenance and repair work on the housing units and other material is usually done by the work crew on the refuge. However, major maintenance and repair is done on a contract basis. Bids are presently being solicited for the repair to the boat shed roof. This roof is approximately 14 years old and is beginning to rust rapidly under the salt air and water. Plans have been formulated to install a new roof on this boat shed and completely rework all existing beams and replace all the electrical wiring.

A daily listing of the maintenance work on Rockefeller Refuge was submitted by the refuge supervisor in the form of a monthly progress report. Copies of this report are on file in the refuge office and in the main office of the Refuge Division in New Orleans, La.

### **Lake 5**

Lake 5 on Rockefeller Refuge is an impoundment consisting of approximately 5,000 acres of marshland lying south of Deep Lake. This impoundment is completely surrounded by a salt water system, however, it now supports one of the most abundant stands of three-cornered grass on the refuge. Three-cornered grass is a valuable food for blue and snow geese as well as furbearers. By supplying a source of freshwater to this impoundment, the attractiveness as a wildlife area would be greatly enhanced.

The Department of Public Works completed the plans and specifications for a bulkhead across Royalite Canal south of Deep Lake. Bids were solicited for this work and a contract awarded to the low bidder in June of 1967. This contract has been completed. In order to provide a source of freshwater to Lake 5 area, two 60-inch culverts have been installed in the east levee connecting with the freshwater system of Lake 6. Also, on the south end of Lake 5, four 36 inch culverts have been installed and will be used for draining the impoundments. This will allow freshwater to flow through Lake 5 and be discharged to the south end and on out into the gulf. This will give an additional 5,000 acres of marshland under water control. The installation of the gated culverts in the east levee and also in the south



Refuge Division draglines are used continuously in maintaining and constructing levees so important in the intensive management of our coastal refuge marshlands.

levee were done by refuge personnel and refuge equipment.

### East End Locks

The most costly project ever undertaken on Rockefeller Refuge was the construction of the East End Locks. This structure was completed in 1961 and provides control over waterflow in the canal leading eastward from the Humble Canal. The locks were of concrete and steel construction and were designed by the Department of Public Works. It was necessary to later add a system of bumpers that would provide a guide for barges entering the locks and would minimize the damage to the concrete structure. These bumpers were heavy timber piling approximately 30 feet in length and braced with diagonal timbers bolted firmly in place. The bumpers were extended approximately 100 feet on either side of the locks. This work was done by refuge personnel. During the past biennium the East End Locks were sand blasted and completely repainted. As these locks are in one of the main entrances on Rockefeller Refuge, they are used extensively by various oil companies as a means of reaching the numerous mineral leases on the refuge. In March, 1968, a drilling rig entered the locks and became wedged between the concrete walls. After several unsuccessful attempts were made to free the drilling barge, it was necessary to cut the bumpers off the barge to permit it to pass through the locks. This was eventually done and the barge was then moved through the locks. Later inspections were made of the damage above the water line and also divers were contracted to make inspections of the damage below the water line. At that time no apparent

damage to the locks were reported. In October of 1969, the hydraulic cylinders were completely dismantled and a thorough inspection indicated this equipment to be beyond repair. These cylinders were bent as a result of the damage done by the barge. A purchase order is presently being issued for the replacement of these hydraulic cylinders and all the connecting hydraulic lines.

### Roads and Bridges

Although the majority of the travel on Rockefeller Refuge is primarily by boat, there is a limited road system on the area. Two of these road systems have been constructed by oil companies in an effort to develop the various mineral leases on Rockefeller Refuge. The remainder of these roads which have been built by refuge personnel and equipment received a considerable amount of maintenance during the past two years. Quick and easy access to the area has proven very valuable in the patrol work on the refuge and also to research areas and an easy means of touring the refuge with visitors for purpose of doing the development work and seeing wildlife on the refuge. The Lake 14 road, probably the most extensive road system constructed by refuge personnel, received an additional 12,000 cubic yards of reef shell on the four mile road. This job was done by contract, however, routine maintenance of grading and reshaping the road was done periodically by refuge personnel. Also, all the weeds and brush were cut along the road way.

The road going to the East End Locks also received routine maintenance during the past two years. Approximately 5,000 cubic yards of reef shell was added to this road and the parking area adjacent to the East End Locks was enlarged. This will give additional parking space to the sports fishermen using the East End Locks.

The road system in Lake 1 was maintained by the oil company using this area. Portions of the Price Lake road were maintained by the oil company using the road to their well location and also the south end was maintained by the Louisiana Wild Life and Fisheries Commission. This section of the road was turned over to the Commission, as a result of an unsuccessful oil drilling venture, and the maintenance work was then assumed by the refuge in order that access could be maintained to this area. In order to keep the road systems on Rockefeller Refuge serviceable at all times, a road grader was purchased.

No additional repair was required on the bridges on Rockefeller Refuge during this period.

### Wildlife Enclosures

During this past biennium, two new alligator projects was started on Rockefeller Refuge which required additional pens and fencing. One site was selected in the south half of Lake 2. In this

area, three 16-acre pens were constructed and fenced with field fencing approximately 7 feet tall. A road has been constructed on the levee adjacent to these pens to provide access to the study area. Plans have been formulated to apply approximately 1,500 yards of reef shell to this road. The contract has been let on this job and work will be completed by the end of January, 1970. These pens will be stocked in the spring of 1970



White-tailed deer display pens on Rockefeller are extremely popular with the many visitors and school groups that visit the Refuge.

and an alligator carrying capacity study will then commence.

Additional pens were constructed in the south end of the goose pasture near the refuge headquarters. These four additional propagation pens were fenced with field fencing wire approximately 7 feet tall with additional poultry netting placed on the top at right angles to prevent the alligators from climbing out of the pens. These pens were necessary in order that additional propagation studies could be undertaken.

Plans and specifications were prepared and contract awarded for constructing additional duck, goose, and deer holding pens on Rockefeller Refuge. The new pens were constructed in the same area where the existing animal pens were located. The contract called for constructing three additional covered holding pens plus two goose yards, a deer pen and two concrete pools. All this work has now been completed during this past biennium and at the present time waterfowl, deer and alligators are on display. In addition; sidewalk, curbing, and watering troughs were added to this new facility.

### Boat Launching Ramp—East End

With the increase in sports fishing activity on Rockefeller Refuge, it was necessary to construct a boat launching ramp capable of handling the increase sport fishermen using the Humble Canal exit into the gulf. Prior to this, a small boat launching ramp was available in this area, however it was privately owned and poorly main-

tained. A small access road was constructed around the storage area at East End. This road was previously used by wildlife personnel as an access to and from the seaplane ramp and also used for loading out material from this storage area. Approximately 5,000 cubic yards of sand was placed around the end of the seaplane ramp and also an additional 3,000 cubic yards of reef shell were added to the top of the sand. Provisions were made for cars to use the seaplane ramp and also additional parking area was provided. The access channel leading to the seaplane ramp was deepened.

### Boathouse and Work Shop

A new boathouse and equipment storage shed was constructed at the Lake 14 patrol camp on Rockefeller Refuge. Prior to the construction of this facility, a small boat shed was available for Commission-owned boats, however, with the increase in development work on this area and also stepped up patrol activities in the surrounding marshes, additional space was necessary to house the Commission-owned boats. At the present time, this new facility provides adequate storage for the boats and equipment that are assigned to this area. A new 5KW lightplant was purchased and is presently housed in this storage shed. Plans have been formulated to remove the old boat shed, extend the bulkhead using steel interlocking sheet pilings and back fill this area. This should provide additional parking facilities adjacent to the Lake 14 camp.

### Water Control Structures

Two sites have been selected for the installation of Wakefield weirs south of Lake 15. These sites are in the right hand fork of Rollover Bayou. Originally one of these sites were plugged with an earthen dam, however, due to the high



The installation of aluminum weirs in tidal channels stabilizes water levels in the marshes and ponds behind the structures.

tides which prevailed in this area, this earthen plug eventually washed out. Three small weirs have been constructed on the south side of this bayou and with the addition of these two proposed sites, approximately 5,000 acres of marshland will be enhanced as a wildlife area. All the necessary steel and interlocking sheet pilings and batter piling have been brought to the job site and these two weirs will be completed by February of 1970. All this work was done by refuge personnel and equipment.



Stop log water control structures have proven to be effective in controlling water levels in brackish water impoundments.

### Price Lake Management Unit

With the construction of the road to Price Lake by the oil companies, additional plans were made to connect this road with the levee running south of Price Lake just adjacent to the beach and paralleling the beach to Miller's Lake. This levee

would then tie in to the two weirs already installed in Miller's Lake and would encompass some 7,000 acres. This area has some of the highest potentials as a waterfowl and fur producing area on the refuge. With the levee paralleling the beach, this will prevent high tides from coming over the natural beach rim and flooding this management unit. This project was started in the winter of 1968. Work has progressed on this levee which is approximately 7 miles long and is near completion. Approximately 75 per cent of this levee has been constructed with the first lift. Additional plans require a second lift to be made as soon as time permits. The levee has been constructed with a staggered bar-pit system.

### Refuge Patrol and Protection

In accordance with the deed of donation under which Rockefeller Refuge was accepted as a wildlife refuge, a staff of enforcement agents have been maintained on the area. Constant patrols were maintained year round with primary emphasis being placed on the protection of the alligator population during the summer months, and winter patrols were maintained to prevent hunters from venturing on the refuge from adjacent privately owned lands. Rockefeller Refuge winters a tremendous number of ducks and geese and constant patrols have to be maintained.

The sports fishing program begins on the refuge March 1 and continues through the summer months and terminates October 1 of each year. A visitor's permit is required and obtained at the refuge office free of charge. Agents make frequent inspections of boats and fishermen in order to check the necessary permit. From time to time agents are assisted by agents of the Enforcement Division in patrolling the refuge and adjacent marshland.



Patrol camps serve as a base station for field operations on the various refuges.

## MARSH ISLAND WILDLIFE REFUGE

**HARVEY H. LOURD**  
Refuge Supervisor

### Water Control Structures

With the installation of various water control structures in the drainage systems of Marsh Island Refuge, and with the construction of the impoundment system, more than 50,000 acres of marshland have been improved for waterfowl habitat. Prior to the installations of these structures, this area was greatly affected by daily tidal flow, resulting in an unstable water condition in the ponds and marshes. This situation greatly hampered the production of desirable aquatic waterfowl food plants in this area.

These low-sill weirs are set about 6 inches below marsh level, allowing high tides to flow over the structures, but maintaining permanent water in the ponds and pot holes. All weirs on Marsh Island Refuge are of three types; wooden sheet piling treated with creosote, steel interlocking



Marsh Island personnel, using Refuge Division equipment, are pictured above installing a low sill dam to improve water conditions on a considerable acreage of marsh.

sheet piling and aluminum. These weirs vary in size from 10 feet to as long as 140 feet in length. To date over 25 weirs have been installed in the drainage system on Marsh Island Refuge. The Refuge Division has recently purchased a new spud barge which will be used to transport the various equipment and dragline to the job sites.

Numerous water control structures were installed during the past two years, adding appreciably to the amount of improved habitat available for wildlife. Weirs were installed in Nancy Bayou, Aucoin Lake, Aucoin Bayou (141 feet in

length), a tributary of Aucoin Bayou, and in the Superior Canal. The levees along Bird Island Bayou and the Oyster Lake Canal were reshaped and raised in an effort to stabilize water levels inside the levees. A steel bulkhead, 98 feet in length, was constructed on the north end of Nancy Bayou as a replacement for the earthen plug which washed out.

Refuge personnel made routine maintenance checks to the weirs and other control structures on Marsh Island and where applicable maintenance work was performed. The weirs on Bayou Aucoin and Bird Island Bayou were repaired and a channel dredged through Mound Point in order to put shell on the Oyster Bayou weir leads. An entire barge load of shells was placed on the Aucoin Lake weir leads in order to minimize erosion around the edges of the weir. Additional batter pilings were also tied into the Aucoin Lake weir to stabilize the structure.

### Main Camp and Patrol Camps

Routine maintenance work was performed on all installations as required. A new floor was installed in the kitchen and living room of the main camp and the entire camp was completely re-



The main camp located on Bird Island Bayou serves as a base station for personnel working on the Marsh Island Refuge.

painted. A new platform was constructed and water tank installed on the platform at the main camp. Major repair work was accomplished on the Scat #2 and Bayou Chene patrol camps.

The float plane landing ramp which services the headquarters on Bird Island Bayou was completely renovated.

### Equipment Maintenance

Again, as in past years, boat maintenance was a frequent occurrence as a result of damages resulting from the shallow water and numerous oyster reefs on the refuge. Minor repairs were made on the refuge and major repair work was done at the Commission owned wharf in New

Orleans. A small equipment shed was constructed on the recently purchased spud barge. Major repair work was done on the tug, Brant.

A new 28 foot personnel carrier boat, christened the Snipe, was purchased to augment the boats already available for refuge work.

### Cypremort Point Boat House

A site was purchased and boat slip constructed at Cypremort Point to provide docking and storage space for refuge boats and equipment. A boat house will be built and a chain-link fence erected around the perimeter of the property. This development will serve as a center for operations off Marsh Island Refuge.



Dr. Orville Brim and Dr. L. L. Glasgow discussed the overall management objectives of Marsh Island during their tour of the Refuge.



Officials of the Russell Sage Foundation made an inspection of Marsh Island during the past biennium.



Soil samples were taken and analyzed to evaluate edaphic factors influencing plant growth.

### Impoundment Development

By utilizing the two miles of oil company road that was constructed on top of the impoundment levee, the bridge and board road built by the oil company, and the efforts of Commission employees in constructing the remaining road; a road was completed around the periphery of the impoundment. This road will be valuable in providing better access to the 8,000 acre impoundment and adjacent area and it will also provide a convenient means of patrolling the area in an effort to protect the wildlife which use this impounded site.

### Marsh Burning and Trapping

The burning program was accomplished on Marsh Island as it has been in previous years. The burning program began in October and continued until late winter, with the actual burning periods being largely dependent upon rainfall and weather conditions. These burns encourage the growth of desirable wildlife food plants, provide succulent sprout growth for goose usage, and reduce the rough on the marsh.

There was no trapping on Marsh Island during the past two seasons.

### Patrol

During the period under report, refuge personnel made routine patrols to all parts of the refuge. Because of Marsh Island's unique location and easy accessibility from all sides, wildlife protection is a most difficult task. Large concentrations of blue and snow geese in the fall and winter months, plus the increased activity of

alligators during the warmer periods of the year necessitate that a constant patrol be maintained. Due to the high market value of gator hides, frequent night patrols were made in order to protect these reptiles from illegal hunting.

Strategically placed patrol towers and camps were maintained by refuge personnel and used regularly by refuge wardens.

### Research

Research activities on Marsh Island during the past two years will be reported on in the Refuge Division Research Section of this biennial report.

## PASS-A-LOUTRE WATERFOWL MANAGEMENT AREA

ELLIS W. LOGA  
Supervisor

### Public Hunting Program

Pass-a-Loutre, established as a public hunting area in 1921, fulfilled its objectives magnificently during the 1968-69 biennium by providing Louisiana sportsmen the opportunity of pursuing their sport in the tremendously productive delta marshes of the Mississippi River distributary system.

Sportsmen enjoyed excellent success during the 30-day season of 1968-69, averaging 2.36 ducks per hunter effort on the public camp hunting area and 2.25 ducks per hunter effort on the area

open to hunting on a seasonal permit basis. The daily bag limit for 1968-69 was three, with scaup not being featured as a bonus duck.

Participants in the public camp hunting program checked out 2,472 ducks, 11 geese, and 329 coots. The total kill of waterfowl on the area open by seasonal permit, based on the results of a survey of hunters, was projected to be 2,644 ducks, 467 geese, and 100 coots.

Eight two-day hunts were conducted during the 1968-69 public camp program. As has been the policy for the past 14 years, hunting was allowed on Tuesday, Wednesday, Saturday, and Sunday mornings throughout the season. By hunting only in the mornings and on four days each week the birds were not overshot. This also allowed the birds to return to their feeding and resting sites in the evenings, thus insuring a continual supply of ducks throughout the season. Hunters were picked up at Venice on December 13 for the first hunt and the hunts terminated on January 12.

A total of 576 permits for the public camp hunts were issued from the 1,538 applications which were received. Permits issued for the open area totaled 815.

Hurricane Camille dealt Pass-a-Loutre a devastating blow when she hit in mid-August, 1969. Eight of the nine public hunting camps and the entire headquarter's complex were destroyed by the hurricane. As a result of the damages, the public camp hunting program was discontinued and approximately 60,000 acres of Pass-a-Loutre were opened for hunting without special permit.

Hunting was restricted to mornings only on the portion of Pass-a-Loutre lying east of South Pass.



This photograph was one of the last taken of the main camp of Pass-a-Loutre before Hurricane Camille devastated the area.



Remnants of the main camp stand as a quiet reminder of the destructive force of Hurricane Camille.

All day shooting was allowed on the area on the west side of South Pass.

### Development

It would be misleading, indeed, to include a section on development without first mentioning the fact that Hurricane Camille simply devastated much of the development work accomplished on the Pass-a-Loutre area.

Marsh management and developmental activities at Pass-a-Loutre are directly related to the annual deposition of sediments during the periods when the Mississippi River overflows its banks. Extensive stands of delta duck potato and freshwater three square are produced as a result of the deposits and natural manipulation of water levels.

Earthen plugs and dams were constructed during the period under report in order to better stabilize water conditions and thereby encourage the establishment of desirable waterfowl food producing plants. Earthen plugs were installed in the breaks in the natural pass banks of the Sawdust Bend area and in the Rattlesnake Pond area.

A public hunting camp capable of accommodating eight men was constructed on the bank of the City Service Canal near Cheniere Pass.

Pirogue ditches were constructed at four of the public hunting camps so as to provide access to hunting areas during periods of low tides.

The Pass-a-Loutre airstrip was widened from 80 feet to 160 feet in order to better and more safely service the needs of the area.

A new boathouse was constructed in the rear

of the main camp on the slip leading into Johnson Pass. This new facility provided valuable storage and docking space, away from the wave wash caused by the heavy boat traffic on Dennis Pass.

Sixteen duck boats were constructed, fiberglassed, and treated with marine grade paint by Refuge Division personnel. These boats were distributed to the public hunting camps and used by hunters participating in the waterfowl hunting program.

### Research

Biologists of the Refuge Division collected extensive waterfowl kill data for the public camp hunts on Pass-a-Loutre during the 1968-69 season, this being the last season the public camps were operated prior to being destroyed by the hurricane in August, 1969. The total kill of waterfowl by participants in the public camp program for the 1968-69 season is presented in Table 1.

Gadwall took the blue ribbon in number of ducks killed with 1,012 being taken. Gadwall accounted for 41 per cent of the total ducks killed. Baldpate ranked second with 524 (21%) while pintail with 352 (14%) came in third. Green-winged teal pushed scaup from its number four position of 1967-68 with 230 (9%) green wings being tallied. Our records indicate that only six lesser scaup were taken during the past season while scaup ranked fourth in the total kill for 1967-68 with 406 being tallied. The aggregate of all other species totaled 354 to account for 14 per cent of the kill.

Sex and age information was collected from 428 ducks taken at Pass-a-Loutre and is presented in Table 2. This information was collected randomly throughout the waterfowl season.

The combined kill on the open area and public camp area of Pass-a-Loutre totaled 5,116 ducks, 478 geese and 429 coots.

A joint effort of personnel of the Louisiana Wild Life and Fisheries Commission, Louisiana Cooperative Wildlife Unit, Louisiana State University, and the U. S. Fish and Wildlife Service resulted in the removal of 125 surplus deer in 1969 and 150 in 1968 from the Delta National Wildlife Refuge and the subsequent restocking of deer in suitable areas with underdeveloped herds.

Twenty-five deer were ear tagged, fitted with color-coded collars, freeze branded, and released on Delta in 1968 in an effort to gain more life history information on this herd of deer. Also, deer transplanted in 1969 were freeze branded as a method of identifying individual animals following their release.



The equipment storage shed as it appeared immediately following the hurricane.

An aerial census of the deer population was conducted by the Louisiana Wild Life and Fisheries Commission in January of each year and then based on this estimate a permit was granted by the U. S. Fish and Wildlife Service to take a specified percentage of the total herd. After receiving the permit and making initial preparations the Commission assembled its personnel, one aircraft, one helicopter (provided by Louisiana Land and Exploration Company), four airboats, two marsh motorcycles, one tugboat, two trucks and barged the equipment to the predetermined catch sites on Delta.

The deer were driven from the floating marsh into the soft marsh and deep water areas where they were captured, loaded into airboats, and tied up. The deer were then processed at the barge site and transported to Venice by barge.

**Table 1**  
**TOTAL KILL BY SPECIES**  
**FOR PASS-A-LOUTRE PUBLIC CAMP**  
**1968-69 Waterfowl Season. (30 day season,**  
**3 duck limit)**

| <i>Species</i>           | <i>Number Killed</i> |
|--------------------------|----------------------|
| Mallard .....            | 55                   |
| Gadwall .....            | 1,012                |
| Baldpate .....           | 524                  |
| Green winged teal .....  | 230                  |
| Blue winged teal .....   | 88                   |
| Shoveler .....           | 124                  |
| Pintail .....            | 352                  |
| Mottled duck .....       | 27                   |
| Redhead .....            | 2                    |
| Canvasback .....         | 18                   |
| Lesser Scaup .....       | 6                    |
| Ringneck Duck .....      | 11                   |
| Merganser .....          | 22                   |
| Cinnamon Teal .....      | 1                    |
| <b>TOTAL DUCKS .....</b> | <b>2,472</b>         |
| Blue Geese .....         | 11                   |
| Coots .....              | 329                  |
| <b>GRAND TOTAL .....</b> | <b>2,812</b>         |

**Table 2**  
**SEX AND AGE INFORMATION FOR DUCKS**  
**CHECKED AT PASS-A-LOUTRE**  
**1968-69 Waterfowl Season**

| <i>Species</i>       | <i>Sex and Age</i> |             |             |             |
|----------------------|--------------------|-------------|-------------|-------------|
|                      | <i>A.M.</i>        | <i>A.F.</i> | <i>I.M.</i> | <i>I.F.</i> |
| Mottled .....        | 6                  | 2           | 1           | 0           |
| Mallard .....        | 7                  | 6           | 1           | 1           |
| Pintail .....        | 54                 | 5           | 16          | 11          |
| Baldpate .....       | 69                 | 28          | 19          | 22          |
| Gadwall .....        | 59                 | 32          | 16          | 9           |
| Blue-winged Teal ... | 11                 | 1           | 4           | 3           |
| Green-winged Teal .. | 8                  | 4           | 4           | 3           |
| Shoveler .....       | 7                  | 4           | 3           | 6           |
| Ringneck .....       | 1                  | 3           | 0           | 0           |
| Lesser Scaup .....   | 0                  | 2           | 0           | 0           |
| <b>TOTAL .....</b>   | <b>222</b>         | <b>87</b>   | <b>64</b>   | <b>55</b>   |

Overall Age Ratio—0.4 Immature: 1 Adult

Trucks dispatched the animals to the various release sites.

A vegetative study of the 3,800 acre Sawdust Bend Area was carried out through the Louisiana Cooperative Wildlife Research Unit during 1968 and 1969. The objectives of this study were:

1. To construct a type map of the Sawdust Bend Area which was representative of the major plant species in the area.

2. To evaluate, from aerial photographs, gross changes in the surface geology and vegetation zones which have occurred since 1940.

3. To estimate the production in pounds per acre of primary waterfowl food produced on the area.

The field phases of this project have been completed. Work is presently in progress on completing the analyses and compilation of this study.

A continuation of the ecological studies on

freshwater three square, reported on in the 1966-67 biennial, was conducted during the period under report. This research was conducted and findings documented by the Louisiana Cooperative Wildlife Research Unit.



The wharf and newly constructed boathouse in the rear of the main camp at Pass-a-Loutre were demolished by Camille.



Commission owned boats, Zoric and Pintail, leaving Texaco docks in Venice with participants in the Pass-a-Loutre public hunting program.

### Maintenance

Maintenance duties occupied a considerable amount of the overall work output of personnel on Pass-a-Loutre. During the past two years all of the buildings at the headquarters site were cleaned and received a new coat of paint. This included the boathouses, storage house, supervisor's residence, and the main building. The front porch was completely rescreened, as were badly deteriorated window screens on the headquarters building. The boathouse and storage

area in front of the headquarters building was remodeled. The wharf at the main camp was repaired and painted and sand deposited by high river stages was dredged from the docks.

The seaplane ramp at the headquarters area was raised and the approach to the ramp deepened.

The public hunting camps were repaired and maintained in good order, prior to Hurricane Camille. However, Camille destroyed eight of the nine public camps on Pass-a-Loutre. The one camp that weathered the hurricane was moved to the headquarters site, repaired, added on to, and set up as a headquarters building.

The patrol boats Sprig and Skimmer received extensive repairs during the period under report. These boats were sent to the Commission owned wharf in New Orleans and the required repairs were made. Numerous repairs were necessitated on the outboard motors, boats, dragline, and miscellaneous equipment assigned to Pass-a-Loutre.

Fur bearing animals were harvested on Pass-a-Loutre in an effort to remove surplus animals that might otherwise be detrimental to their habitat. Trapping was only allowed following the waterfowl season, so that no conflict would arise between the public hunting and trapping programs. The 1967-68 fur take was about the same as for the previous season, with approximately 5,200 nutria being taken as compared to 5,000 in 1966-67. No muskrat were recorded in the catch.

### COULEE WILDLIFE REFUGE

Management on the small 2,110 acre Coulee Wildlife Refuge is primarily through the maintenance and development of two flooded reservoirs on the area. During the past biennium, new 30-inch corrugated metal culverts with lift gates and spill over funnels attached were installed in the impoundment system. A dragline was used to patch and rework badly weathered and eroded areas.

The lease on the western portion of the area was renewed on an annual basis to complement the ten-year lease on the eastern section of the refuge, which was renewed in 1965.

Boundary lines were reposted with new signs. Sprout growth was removed from boundary lines. A new entrance sign was also established.

Evidence of a successful alligator hatch was reported during the summer of 1968, indicating that the restocking program was at least moderately successful.

The beaver population on Coulee has built up dramatically during the past few years.

Frequent patrols were made in the Coulee area by agents of the Enforcement Division to guard against wildlife law violations.

## ST. TAMMANY WILDLIFE REFUGE

**JOSEPH M. DIRMANN**  
Refuge Supervisor

The small 1,310 acre St. Tammany Refuge is used primarily as a resting area for waterfowl. A build up of the muskrat population provided some trapping on the refuge with the expansion of the population onto surrounding marshlands providing additional trapping on adjacent marshes.

Shoreline erosion along the 10 miles of beach front bordering the north shore of Lake Pontchartrain continues to slowly reduce the acreage of this marsh area.

## STATE WILDLIFE REFUGE

**ODILON MARCEAUX, JR.**  
Refuge Supervisor

### Water Control Structures

Three weirs were constructed on State Wildlife Refuge during the past two years. The locations of these weirs are in Big Island Bayou, North Bayou, and Leto Bayou in Section 32. Two of the structures were constructed of steel sheet piling and creosote timber piling and the weir in Section 32 was built of aluminum sheet piling. The ends of the weirs and bayou banks were reinforced with native shell to retard erosion. The Prien Bayou weir was rebuilt. A steel bulkhead was constructed in the break in the bay shore to stop the erosion and water exchange between North Lake and Vermilion Bay. All work was done by refuge personnel using refuge equipment.

Aerial observations and on the ground trips



Supervisory personnel made periodic inspections to the various water control structures on State Wildlife and where applicable plans were formulated for maintenance and renovation.



The North Lake weir was badly washed out, making repair work a necessity.

were also made to locate potential sites for water control structures. Measurements of weir locations were taken so that appropriate quantities of materials could be barged to construction sites.

The weir on Hog Bayou was repaired with an earthen plug which should control water levels in the Hog Lake area. The weir north of Lake Fearman was repaired and pilings were set to stabilize this water control structure. The extensions to the weir on Big Island Bayou were shelled.



The North Lake weir on State Wildlife Refuge was renovated by Refuge Division personnel.

## Headquarters and Patrol Camps

The main camp at State Wildlife Refuge received considerable remodeling and repairs during the past two years. Both the exterior and interior of the headquarters building were repainted. The roofs of the main camp, day room, tool house, and boat and tractor sheds were cleaned and painted. A storage area was built in the boat house, as well as converting the former fur house at the headquarters complex into a tool and equipment storage building.

A bulkhead, constructed of aluminum sheet piling, was built around the seaplane ramp near the refuge headquarters. This structure will min-



Water control structures installed in marsh drainage systems stabilizes daily tidal fluctuations and maintains water levels in the marsh and ponds behind the structures.

imize erosion of the banks surrounding the ramp. Shells were spread on the bulkhead.

A 10' X 10' fur house was constructed adjacent to the Hog Bayou camp. This structure will greatly facilitate the trapper's handling of his fur harvest and also the area supervisor's periodic monitoring of the fur take. The wharf at the Hog Bayou camp was also repaired.

A double floor was added to the newly constructed trapping and patrol camp on Hog Bayou.

The trappers camp on the south end of the refuge was moved to a higher site on Audubon Refuge land.

## Equipment Maintenance

Routine maintenance was done on all equipment, especially boats, as required. Minor repairs and maintenance were done on the refuge and major repair work was done at the Commission's Wharf in New Orleans.

## Egret Nesting Platform

An egret nesting platform of 60 feet by 6 feet



The construction of low sill dams, such as the one pictured on Hog Bayou, has proven to be beneficial in improving wildlife habitat on the State Wildlife Refuge.

was built on Southwest Pass. This rack was used quite heavily during the 1969 nesting season.

## Marsh Burning and Trapping

During the past biennium approximately seventy per cent of the refuge was control burned each year. This burning program was initiated in October and continued until late February. Timing and placement of the burns were largely dependent upon weather, marsh moisture conditions, and goose and mammal usage.

Trapping success for the 1967-68 season totaled 5,712 animals, quite an increase from the 1,816 animals reported harvested during the 1966-67 trapping season. Fur bearers taken included 3,809 muskrat, 1,885 nutria, 16 mink and 20 otter.

## Boundary Signs and Channel Markers

The boundaries along the coast line and between Audubon and State Wildlife Refuges were posted with new boundary signs. A new 4' X 6' entrance sign was erected at the mouth of Bayou Fearman. New boundary signs were posted where replacements were needed on the various lines and where applicable older signs and markers were repainted.

## SALVADOR WILDLIFE MANAGEMENT AREA

IRVIN H. DARES, JR.  
Supervisor

The Salvador Wildlife Management Area, comprised of 28,469 acres, is located along the northwestern shore of Lake Salvador in St. Charles

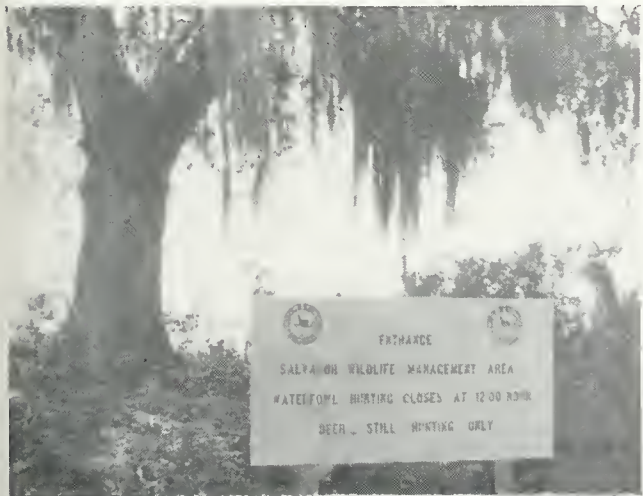
Parish. This area was purchased on October 7, 1968 by the Louisiana Wild Life and Fisheries Commission.

The Salvador tract is primarily a freshwater marsh type and is interspersed with numerous marsh ponds which provide suitable conditions for the production of desirable waterfowl food plants. There are several large stands of cypress timber on the northern extremity of the area on the old natural stream levees which were once channels of the Mississippi River. The most common marsh plants endemic to this area are maiden cane, cattail, bull tongue, aquatics; and wax myrtle, black willow and cypress on the higher sites. Wildlife species on this area include deer, rabbits, squirrel, alligators, rail, waterfowl, numerous bird species, mink, nutria, raccoon, muskrat, otter and a wide array of aquatic life.

Channels dug in previous oil development operations have created ideal conditions for excellent freshwater sports fishing. These canals also serve as desirable routes for access to hunting areas.

Access to the Salvador Wildlife Management Area is primarily through three routes. The first, and more than likely the most utilized, is Bayou Segnette from Westwego into Lake Cataouatche and west to the area. The second route is through the Sellers Canal to Bayou Verret into Lake Cataouatche. The third route is through Bayou Des Allemands to the southwest end of the area.

Future management plans on the Salvador area are primarily aimed at increasing the waterfowl utilization of the area. The primary management tools will be the construction of earthen dams, levees, and the installation of various water control structures similar to those used so successfully in our various coastal refuges. These structures will regulate water levels throughout the year for management purposes. Access routes to choice hunting and fishing areas will also be constructed.



Signs were established at the major entrances of the Salvador Wildlife Management Area prior to opening the area to Louisiana sportsmen.

The Salvador tract was opened to the public during the 1968-69 and 1969-70 hunting seasons and provided a considerable amount of high quality recreation for Louisiana sportsmen. Sport fishing is allowed on a year round basis.

Game law regulations for Salvador permitted a 10 day buck only deer season. Use of dogs was restricted to the use of recognized breeds of retrievers during waterfowl season and the use of beagles for rabbit hunting from January 10-February 15. Fishing regulations and creel limits also coincide with the statewide regulations.

Trapping of fur-bearers was allowed with trapping rights going to the highest bidder on specified trapping leases during the 1968-69 season. During the 1969-70 season trappers were assigned trapping areas and a fee of 10% of the total sale of fur charged as the state's share of the fur income. This is the same procedure followed on all of the refuge areas.

## POINTE-AU-CHIEN WILDLIFE MANAGEMENT AREA

LLOYD SONGE, JR.  
Supervisor

The Pointe-au-Chien Wildlife Management Area was purchased on October 7, 1968 and put under the direction of the Refuge Division. This new area is located approximately 15 miles southeast of Houma in Terrebonne and Lafourche Parishes and comprises 27,504 acres of prime marshland.

The marsh types of Pointe-au-Chien were classified as extending from slightly brackish on the more southerly sections of the area, to intermediate in the southern one-third and to fresh in the northern sections of the tract.

Future management plans on this area will be directed towards developmental activities that will further enhance the area as wintering grounds for migratory waterfowl as well as resident populations of marsh life. All future work will be done with hunting and fishing as the main land use practices of the area.

This tract is broken up by numerous waterways which can be put under intensive management by the construction of numerous low level Wakefield type weirs and earthen plugs. Extreme care will be exercised in the construction of any new water courses on the area to prevent damage by the daily tidal fluctuations of water levels. Access routes to the more productive hunting, fishing and trapping areas will continue to be installed.

Trapping was allowed on a land lease basis. The entire management area was divided into tracts with the individual tracts being advertised for trapping leases and awarded to the highest bidder during the 1968-69 season. A change to

the standard system was made in the 1969-70 season.

The Pointe-au-Chien tract was opened to the public during the 1968-69 and 1969-70 hunting seasons and provided a considerable amount of recreation for Pelican State sportsmen. Sport fishing was permitted on a year round basis.

Game law regulations on Pointe-au-Chien permitted a 10-day, bucks-only deer season. Seasons and bag limits for all other game species coincide with state and federal regulations. Use of dogs was restricted to the use of recognized breeds of retrievers during waterfowl season and the use of beagles for rabbit hunting from January 10 to February 15 (1969-70).

Fishing regulations and creel limits were set to coincide with statewide regulations. No commercial fishing was permitted except by Commission action for the removal of undesirable rough fish.

## REFUGE DIVISION RESEARCH

**TED JOANEN**

Biologist

**LARRY L. McNEASE**

Biologist

**HOWARD H. DUPOUE**

Biologist

**W. GUTHRIE PERRY**

Biologist

The research section of the Refuge Division is staffed with four biologists and one biologist aide. The work of this section deals primarily with in-

vestigating new and evaluating present marsh management practices for both fish and wildlife, life history studies on the alligator, various studies dealing with aviculture, pond culture of several species of marine and freshwater fishes, bioassay work, and population trends of fishes along the refuge and adjacent gulf. These studies are presently underway on the various refuges of this division. Also, a considerable amount of time was spent consulting with landowners interested in marsh management, catfish and crawfish culture.

With the findings from the different research studies, definite plans could be made to more wisely use the 300,000 acres owned and managed by the Commission for fish and wildlife. The results of these research findings are published in technical journals or circulars with international distribution. Also, this information is made available to private landowners interested in marsh management or fisheries management.

Personnel of the research section traveled to other state owned areas in order to view the management practices employed on these different areas and compare these with the practices presently being employed on the refuges in Louisiana.

Cooperative studies between the biologists of the research section and the Louisiana State University, the Louisiana Cooperative Wildlife Research Unit and the Louisiana Cooperative Fisheries Unit were also carried out during the past biennium. A vegetative type map of the Louisiana coast was prepared during the summer of 1969 and copies of this map are available at the main office of the Louisiana Wild Life and



Nests were equipped with instruments to record basic information involving this very important phase in the life cycle of the alligator.

Fisheries Commission in New Orleans, Louisiana State University, Louisiana Cooperative Wildlife Research Unit, Baton Rouge and at Rockefeller Wildlife Refuge. The objective and the purpose of the present studies and a short report listing some of the findings of the research section are listed below.

### Alligator Nesting Study

From 1964 through 1968, a study was underway to gather information on the factors associated with alligators nesting on Rockefeller Refuge. During this study, nest were equipped with Stephens Model F recorders, Taylor temperature recorders, and Short and Manson Hair hygrogaphs. These instruments were used to record movement of the female over the nest, nesting temperatures inside the egg cavity and relative humidity of the egg cavity. Data from the move-



Detailed studies involving the nesting ecology of alligators on Rockefeller Refuge have provided valuable information regarding some of the factors influencing reproduction.

ment recorders indicates alligators paid little attention to their nest after the eggs were deposited. Each nest varied in the number of crossings, with one nest recording as few as 8 visits and one nest as many as 25 visits during the 65-day period. The majority of the 66 visits tallied were recorded in the first, second, third, and ninth week of incubation.

Temperatures and relative humidity inside the egg cavity remained fairly constant throughout the incubation period. However, outside recording or the control unit showed extreme daily fluctuations.

Of the 315 nests followed during the course of

this study, 79.7 per cent were located in natural marsh, 13.6 per cent were found in the impounded marsh, and 6.7 per cent were found on the levees.

The alligator supposedly protects the nest from predators and intruders, but this was not demonstrated during the study. Several nest were destroyed by raccoons with the female present at the nest site. Of the 315 nests examined, only 29 females or 9.2 per cent made any attempt to protect their nest when visited by persons conducting this study. Weekly checks were made on each nest and it was found that these alligators were the only permanent residents at the nest site during the weeks of incubation. As the incubation period progressed, only 24 or 7.6 per cent were seen at the nest site on the weekly visits.

The average clutch size was found to be 38.9, averaging from 2 to 58 eggs per nest. Of this, 52.5 per cent of the nest examined contained eggs that were cracked. This varied from one to as many as 48 eggs in a single nest. It was found that as long as the inner shell membrane was not broken, these eggs would hatch normally.

The size of the nesting female were found to be between six feet and as large as eight and one-half feet (hind foot measurements taken from the tracks of the female and related to the total length). No correlation could be made between the size of the female and the number of eggs laid.

The amount of predation by raccoons was found to vary from one year to the next. However, predation followed much the same pattern for all the nest except a few which were destroyed during early weeks of incubation. Predation was found to occur just after the eggs began to crack along the longitudinal axis, usually at the end of the seventh week of incubation.

Nesting was found to occur from the first week in June and extend into the first week of July. However, the bulk of the nesting took place within a two week period each year and with very few nest being located prior to or after this period. Nesting success for 266 nests showed 68.3 per cent hatched successfully, 7.3 per cent were partially infertile, 5.8 per cent were infertile, and 18.6 per cent were either destroyed by racoons or lost to high water. Only 32.3 per cent of the nest examined were classified as incomplete nesting attempts and contained no eggs.

Hatching success was determined from 154 nests followed throughout the incubation period of 1967 and 1968 and found to be 58.2 per cent for the two year average.

### Biotelemetry of Alligators

For the past several years, extensive studies have been conducted on the life history of the alligator here on Rockefeller Refuge in order to formulate management practices for this species.

The alligator population has declined to where it is found only in good numbers on the refuges located throughout the state. Also, large privately owned tracts of land which afford the necessary patrol and protection possess sizeable population of alligators.

A nesting study has been set up on Rockefeller Refuge in order to determine some of the factors associated with nesting alligators. The use of telemetry will add the necessary information on the management of the female during the incubation period. By daily monitoring the female, we will be able to determine the home range and also be in a position to better understand the habitat requirements needed to manage this species properly. The objectives of the biotelemetry study are: (1) to determine the location, size, and shape of the home range of the nesting female alligator, (2) to determine the habitat requirements and preferences of the nesting female, and (3) to determine the daily activity of the nesting female under natural conditions.

A purchase order has been issued to Mr. Sidney L. Markusen, electronic specialist of Esko, Minnesota and all the necessary tracking transmitters and receivers have been received. During the summer of 1969, six nesting female alligators were instrumented with radio telemetry units. These units were first activated, waterproofed and attached to the female in the laboratory. The female was then returned to the original capture site and released. Two permanent stations around each release site were set up and a daily monitoring of each unit was begun in May of 1969 and continued through November of 1969. In the late spring or the onset of this study, readings were taken during the daylight hours and also at night; however, during the warmer summer months, gators were less active during the day and few readings could be obtained. It was later decided that all readings were to be made at night when gators were most active. During the months of May and June, two readings were taken on each alligator daily. However, as the study progressed, it was found that the second reading was unnecessary and for the remainder of the study, just one reading in a 24-hour period was taken. These readings involved locating signals at two permanent stations for each alligator, then through a system of triangulation on a compass bearing, the exact location of the alligator could be plotted on the map. Transmission was hampered greatly when the alligator would submerge and no signal was received when the alligator was in its den. However, when the alligator was on the surface, transmission was approximately one mile. Battery life of the telemetry units varied with the shortest battery life approximately two weeks and two units lasting a period of five months. Additional studies are planned for the spring of 1970. Adult males are to be instrumented during the early

spring of the year in an attempt to try and follow the courtship and also the home range of these reptiles. An additional purchase order has been issued, and work will resume in early April of 1970.



Alligator nests were located in late June, using a light airplane to find the nests and a marsh buggy to establish a marker at the nest site.

### Alligator Censusing

With the completion of the alligator nesting study here on Rockefeller Refuge, a further refinement of alligator censusing method was provided with the information obtained from this nesting study. Originally a system of night counts, recapture of tagged animals, call counts, and nest counts were used to determine populations. However, in using the nesting count data, the incompleting nesting attempts were not taken into consideration. Originally biologists tried to distinguish between a completed nest or one with eggs from an incomplete nest. It was later found this was almost impossible to make this distinction from the air. A spacing factor, that would separate a good nest from an incomplete nest, was tried. This again proved very complicated as good nest were found as close as 150 feet apart. All the nests, were counted, marked and returned by buggy to investigate each for the presence of eggs. By using this method over a period of years, a correction factor was determined that we then could apply to our total aerial counts. These incompleting nesting attempts made up approximately 32.3 per cent of the total nest tabulated. This figure was based upon a four year average for the incomplete nesting attempts. From this nesting success, hatching success and number of young produced each year was calculated.

The population status of a species is important also when establishing regulations and quotas

for harvest operations. Likewise, information as to the number of animals occupying a certain area is important when it is necessary that a particular animal population is kept in balance with its food supply or with other species occupying a common habitat. This is particular true in the case of large predaceous animals such as alligators.

### Alligator Carrying Capacity Study

Plans for this study were formulated in 1967 and work was begun on three 16-acre alligator enclosures. Objectives of this study are to determine the number of alligators that a marsh will support under various conditions. Work was begun on this project during the spring of 1968, when three 16-acre pens were surveyed and levees were built enclosing the three 16-acre areas. A canal was excavated on the inside surrounding each enclosure. A wire fence, approximately 6 feet tall was constructed on this levee and two gates were built per pen. These pens have been constructed in the de-watered area on the south end of Lake 2. This is one of the impounded areas on Rockefeller Refuge that is presently being used as a part of the captive goose nesting flock. A contract has been let to haul, grade, and compact some 1,500 cubic yards of reef shell in order to provide an all season road surrounding the west and south half of these pens. Stocking of the pens will begin in the spring of 1970. Pens will be stocked with different stocking rates and with different size alligators. Food in the form of small fishes and fur bearing animals, along with birds will be sampled by the use of traps, both wire and steel traps, block off nets and rotenone to determine the food availability of this area. Alligators will be recaptured in the fall of each year and growth will be then determined. Stocking of each pen will increase or decrease depending upon the number of animals and the growth attained during that growing period. Information gained from these studies will be valuable in determining the number of alligators a marsh will support and also in regulating harvest regulations.

### Alligator Collection Study

During the summer of 1969, an alligator collection study was begun in order to determine (1) the preferred food habits of the alligator in Louisiana, (2) to identify the food items of the stomach content, (3) to correlate food occurrence with availability, (4) to correlate food preference with salinity and marsh types, (5) to determine a method of aging alligators by internal body characters, (6) to determine the useful character in eye lens as a possible way of aging alligators, (7) to collect reproductive organs from both sexes, (8) to determine sexual

maturity in males, and (9) to determine the peak breeding period and laying period in females.

Alligators were collected from March through October, 1969. Approximately 75 alligators were collected on Rockefeller Refuge. These alligators were weighed, measured, stomachs were removed, also portions of the body scales were removed, eye lens were removed, head and jaw bones were saved and the reproductive organs were taken to the lab for analysis. In the lab, vas deferens were analyzed under a microscope for the presence or absence of live sperm. Food availability samples were taken in areas where alligators were collected on a monthly basis. This was done by dragging a 50-foot bag seine, weighing and measuring the fish to determine production per acre. The stomach content, eye lens, and ovaries will be examined during the spring of 1970.

### Alligator Restocking Program

In April of 1968, the Louisiana Wild Life and Fisheries Commission was requested by the Terrebonne Parish Police Jury to restock a 400,000 acre tract of marshland with deer and alligators. This tract of land located in Terrebonne Parish lies south of the Intracoastal Waterway, east of the Atchafalaya River, and west of Minor Canal, Falgout Canal, and Bayou du Large. It will be closed to deer and alligator hunting for a period of five years, or such a time that the populations have increased to a harvestable degree.

The alligator population is extremely low throughout the coastal marshes, and are found in good numbers only on the state and federal refuges. Also, as a result of the successful restocking program conducted in Cameron Parish, a sizable population of alligators has become established. The restocking of alligators has proven to be a sound management practice by speeding up the repopulation of unoccupied habitat.

During the past two years, 230 alligators were released on the 400,000 acre tract of land. These alligators were taken from Sabine National Wildlife Refuge, and the state-owned Marsh Island Wildlife Refuge located in Vermilion Bay.

All alligators were captured by means of an alligator snare of the type developed by the personnel of Rockefeller Refuge.

### Alligator Hatching Study

Within recent years increasing interest has been shown in Louisiana and the other Southeastern states in alligator farming as a commercial venture. Such operations involve sizeable investment; consequently, methods to reduce the risk involved should be employed where possible.

One phase of the operation subject to considerable risk is in the incubation of eggs and han-

dling of the young. Eggs permitted to incubate in brood pens are subject to losses associated with weather conditions, predators, accidents and so forth. However, with incubation done under controlled conditions, losses from these sources would be greatly reduced. The young subsequently hatching under controlled conditions could also be reared under controlled conditions, thus increasing the survival.

Likewise, in certain marsh areas managed for alligator production, some consideration is being given to collecting eggs in the field for incubation under controlled conditions. As in pen-rearing operations this would be done not only to reduce nest and egg losses, but also to increase the survival rate among the young thereby produced.

In order to determine the proper temperature for incubation a study was conducted on alligator eggs collected from the marsh on Rockefeller Refuge. The eggs were collected in July, placed in wide mouth jars and held at five different temperature levels. The temperatures used were 75, 80, 85, 90 and 95 degrees Fahrenheit and an equal number of eggs incubated at each temperature.

Hatching success was very low and living young were produced only at the 85 degree level. Over 50 per cent of the eggs producing fully developed embryos were at the 85 degree level. At 75 degrees the embryos died in the early stages of development. Considerable variation was noted in hatching success between individual nests.

The relative humidity surrounding the incubating eggs appears to be a critical factor and future studies will be directed at testing hatching rates at different humidities within various temperature levels.

### Alligator Pen Studies

The alligator pen rearing project on Rockefeller was drastically accelerated during the past two years as a result of the increased interest in the pen raising of gators, and also the need to learn more about the basic life history and basic requirements of alligators. The original five pens, constructed in 1966-67 were augmented by the six new pens constructed during the 1968-69 biennium.

*Pen Construction.* The original five pens were constructed by digging a  $\frac{1}{4}$ -acre pond and then fencing the pond, berm, and a section of the levee with 2" X 4" X 6' welded wire. A two foot chicken wire retainer was later added at the top to prevent the gators from escaping. However, problems were encountered with erosion of the levee along the fence line and also digging into the levees by the alligators. In order to rectify the situation, new pens were constructed by simply fencing a section of marsh after digging scattered wells inside the pens.

*Courtship and Nesting.* The first incidence of

bellowing was recorded on April 26, 1968 and April 14, 1969. The last time bellowing was heard was in the early morning hours of June 5, 1968 and on June 7, 1969. Bellowing was most generally heard between 6:30 AM and 7:30 AM, with the actual period of bellowing among gators only occupying about a 10-minute interval within the hourly framework.

The position of the alligator during the process of bellowing seemed to be pretty well the same



A big female alligator stands guard at her nest site. Nesting studies on Rockefeller Refuge indicated that only 9.2 per cent of the nesting females made an attempt at protecting their nest.

for all of the ones observed. They seemed to float very high in the water and also activity seemed to be increased immediately prior to and following bellowing. The stance in bellowing was with the anterior  $\frac{1}{2}$  to  $\frac{1}{3}$  of the body on a sloping bank or in shallow water with the head and tail arched. Water was thrown outward from the throat region as a result of the vibrations of the throat muscles.

Activities which were strongly suggestive of the copulatory response were recorded on May 21, 24, 27, 30 and on June 7 for 1968. No such observations were made in 1969.

Five nests were constructed in the six study pens under observation in 1968 and only two nests were recorded for the nesting season of 1969. Both nests in 1969 produced a good hatch. Two nests, out of the total of five, did not hatch in 1968. The average incubation period for the nests was 67.3 days in 1968, and 67.5 days in 1969. The average number of eggs laid for the five nests in 1968 was 36.6.

### Alligator Winter Feeding Study

Feeding trials were conducted on captive alligators held in the display pens on Rockefeller Refuge beginning during the fall of 1967 and extending into the spring of 1968. The purpose of this experiment was to determine the extent

of feeding among various size classes of alligators during the period of winter dormancy, and to measure and determine some of the conditions associated with feeding. The gators used in these trials were of the 3, 4, 5, 6, 8, 10, and 11 foot size classes.

The 3, 4, and 5 foot size classes fed actively during the trials conducted during October. Of the 67 feeding attempts made during the three month period from October 25–January 30, only 11 attempts were successful and then only with gators of the 3, 4, and 5 foot size classes accepting food. The 8 and 10 foot gators did not accept food until March 8, 1968. The 11 footer was not observed to take food at any time during the duration of this feeding period.

No feeding was observed where the water temperature was 60° F. or less, or when the air temperature was 54° F. or below.

Feeding was recorded on 12 per cent of the clear days, 35 per cent of the partly cloudy days and 40 per cent of the cloudy days, again strongly indicating that feeding activities are temperature dependent. Temperature differentials for the three types of weather conditions are listed in the following table.

**AVERAGE AIR TEMPERATURE AND WATER TEMPERATURE FOR ALL DAYS ON WHICH FOOD WAS ACCEPTED, ACCORDING TO WEATHER CONDITIONS**

| <i>Weather Condition</i> | <i>Average Air Temp.</i> | <i>Average Water Temp.</i> |
|--------------------------|--------------------------|----------------------------|
| Clear .....              | 55.5° F.                 | 62.0° F.                   |
| Partly Cloudy .....      | 56.5° F.                 | 62.9° F.                   |
| Cloudy .....             | 59.6° F.                 | 63.8° F.                   |

### Impoundment Study

Impoundment studies have been conducted on Rockefeller Refuge since the fall of 1958. The primary objectives of this study were to determine the ecological changes in the vegetation in the 13 Rockefeller Refuge impoundments and to relate these changes to annual climatic and edaphic factors. Sampling was done in each impoundment and control area during the early fall of each year after the growing season. Sampling was done by line transects with markers placed at one hundred foot intervals through each impoundment. This line was checked each fall with a marshbuggy or airboat and the vegetation tabulated, as it occurred, along the transect. The impoundments were sampled on Rockefeller Refuge in September, 1968, and September, 1969, using this method.

Water levels and water salinities in each area were checked monthly by a refuge biologist and a record kept on file in the refuge office. Information on rainfall was determined by a rain

gauge located at the main headquarters of Rockefeller Refuge.

The total rainfall for 1968 was 50.8 inches, four inches less than for 1967. Heaviest rainfall of the year was in June and July and in the periods of September and November. The highest monthly rainfall was recorded in November at 10.8 inches.

High water levels and low salinities were the general rule in both the impoundments and con-



Impoundment management has increased the quantity and quality of food plants available for waterfowl.

### Monthly Rainfall

| <i>Month</i>    | <i>1968</i> | <i>1969</i> |
|-----------------|-------------|-------------|
| January .....   | 4.04        | 1.43        |
| February .....  | 3.18        | 3.94        |
| March .....     | 2.72        | 5.43        |
| April .....     | 1.88        | 6.09        |
| May .....       | 2.86        | 4.87        |
| June .....      | 6.01        | 2.23        |
| July .....      | 8.92        | 9.79        |
| August .....    | 1.45        | 1.15        |
| September ..... | 5.24        | 1.44        |
| October .....   | 0.77        | 1.49        |
| November .....  | 10.78       | 0.67        |
| December .....  | 2.93        | 4.26        |
| TOTAL .....     | 50.78       | 42.79       |

trol areas during 1968. As a partial result of these two factors, the impoundments failed to produce the abundance of vegetation during 1968 as was noted for the five year average from 1963–1967.

Production of annual grasses was very low in the majority of the impoundments and control areas in 1968. Drying of the marsh floor, which is conducive to germination of desirable annuals, simply did not occur to any extent. Two perennials, wiregrass and saltmarsh grass, dominated

all of the areas transected with the exception of Lakes 8, 10, 13, and 15.

The total rainfall in 1969 was 8 inches below that of 1968. Rainfall amounts from August through November was extremely light, resulting in drying of large expanses of marsh. All of the impoundments on Rockefeller, with the exception of Lake 4, went through at least a partial dry up resulting in excellent production of waterfowl food plants. Production of desirable duck foods was the best recorded since 1963.

| Sample Location            | P     | Concentration in PPM |      |       | pH  | % Soluble Salts | % Organic Matter |
|----------------------------|-------|----------------------|------|-------|-----|-----------------|------------------|
|                            |       | K                    | Ca   | Mg    |     |                 |                  |
| Lake 1 Vegetated .....     | 85.8  | 455+                 | 1256 | 1000+ | 4.5 | 3.78            | 31.6             |
| Lake 1 Non-Vegetated ..... | 70.8  | 455+                 | 2135 | 1000+ | 5.8 | 2.19            | 32.1             |
| Lake 3 Vegetated .....     | 93.5  | 424                  | 1832 | 1000+ | 4.6 | 2.52            | 40.9             |
| Lake 3 Non-Vegetated ..... | 74.2  | 455+                 | 2057 | 1000+ | 4.9 | 2.00            | 35.2             |
| Lake 4 Non-Vegetated ..... | 118.5 | 455+                 | 2802 | 1000+ | 6.2 | 1.95            | 29.6             |

Additional samples were taken in the fall of 1969 and a final analysis (taking into account natural moisture contents from each sample) will be completed pending the outcome of this set of samples.

Water salinities from these impoundments ranged from a high of 16,000 ppm to a low of 1,400 ppm.

### Brush Control

The five year study was conducted on Rockefeller Refuge in order to study the effects of certain chemicals on *Baccharis halimifolia* on the levee systems. Three one-mile test plots were selected which had almost pure stands of *Baccharis*, along with roseau cane, *Phragmites communis*, and wiregrass, *Spartina patens*. Aerial spraying was done in the fall of 1966 and again in the spring of 1967 and 1968. A mixture of 2-4-D and 2-4-5-T ester were used at a rate of 5 gallons acid equivalent per acre. At the time of spraying, *Baccharis* was matured and ranged in height from 5 to 7 feet and in some cases, 4 to 5 inches at the base. This plant was in full flower at the time of the fall treatment and in full leaf stage at the time of the spring treatments.

*Baccharis* affords little food or cover for wildlife and with its dense canopy the shading effect prohibits plant growth at the ground level. With access canals being used daily by oil companies and others, the resulting wave wash from boats has greatly increased erosion rates. On one study plot it was estimated that over 50 per cent of the levee had been lost due to wave action caused by daily boat traffic. Without the *Baccharis* a

A study was begun in May, 1968 and was continued throughout this report period to determine the effects of flooding and late spring and early summer dry ups upon edaphic factors and vegetative types inside impounded areas. Soil sample analyses, water level recordings, and water salinities were determined periodically during 1968 and 1969.

Results of the initial phases of this study indicated the following results:

suitable grass cover could be established which would help reduce the erosion problem.

Approximately 36 acres of *Baccharis halimifolia* was treated with a combination of 2-4-D and 2-4-5-T esters during the fall of 1966 and the spring of 1967, and approximately 80 acres was treated during the spring of 1968.

Results of these treatments indicate that it may be possible to obtain an effective kill using a single treatment providing this treatment is applied in the spring of the year. The combination of fall and spring treatment obtained an average kill of 94.3 per cent. The fall application failed to obtain a root kill, but did defoliate over 90 per cent of the *Baccharis* on both test plots. The spring application did obtain a root kill and was found to be most effective of the two applications. The most successful results have been obtained on plots using three pounds of 2-4-D and one pound of 2-4-5-T esters with a wetting agent applied at a rate of five gallons total mixture per acre. A 97.5 per cent kill was obtained on this plot. This area received two applications. The experimental goose pasture was treated with three pounds of 2-4-D and one pound of 2-4-5-T esters in the spring of 1968. This application obtained an average kill of 95 per cent. Reinvasion of *Baccharis halimifolia* on these levees were studied in the summer of 1969. Plots sprayed in early 1966 it was noted that reinvasion of *Baccharis* was nearly 100 per cent on the levees sprayed. The plant succession in the three study plots were primarily wiregrass, *Pluchea* and deer pea, *Vicia ludoviciana*. In the experimental goose pasture reinvasion of *Baccharis* was almost nill. All the dead *Baccharis* were removed by mechan-

ical means and a follow-up of periodic mowing was carried out in this area. Reinvansion in this 80-acre experimental goose pasture was primarily bermuda grass. Preliminary results in this study show that it may be possible to use only one treatment of 2-4-D and 2-4-5-T esters and obtain better than 90 per cent kill, providing canopy covering is not too great. However, in areas of dense canopy cover, two applications will be necessary. Also, it was found to prevent reinvansion of *Baccharis* it would be necessary to follow-up with a mowing procedure which would prevent the reoccurrence of this plant.

### Canada Goose

The Canada goose, once a common winter resident to the coastal marshes of Louisiana has declined over the years to just a few thousand birds. The reduction of Louisiana's wintering population has been brought about by the establishment of the goose management units in Missouri, Illinois, and Wisconsin. These refuges not only provided protection, but also farming programs were initiated to entice and hold these geese in the areas.

As the population increased on these northern refuges and required more food so did the farming practices. This brought about a steady decline in the number of Canada geese coming to South Louisiana.

If Louisiana is to again have Canada geese, nesting birds must be established in the state such as the mottled duck. A study was set up on Rockefeller Refuge and the primary objectives were:



At total of 362 Canada goslings were hatched during the 1968 and 1969 nesting seasons on Rockefeller Refuge.

1. To obtain suitable Canada goose breeding stock.
2. To determine the factors associated with pair formation and nesting in Louisiana.
3. To determine the care needed by both adult and immature geese.
4. To determine if the young produced in Louisiana will remain here to nest if permitted to fly.

This program was begun in 1960 and since that time several hundred young birds were produced.

Of the 91 Canada goose nest followed during 1968, 45 (49.5 per cent) produced young. All nests were included in which one or more eggs



The feasibility of establishing a resident flock of Canada Geese is being studied on Rockefeller Refuge.

were laid. Of the 31 nests in which the parents were permitted to incubate the eggs, 19 produced young. When compared with previous years, this shows 1968 higher than 1967, 44.0 per cent and 1966 (50 per cent).

During the 1968 nesting season from 386 eggs laid 146 young were produced.

The results of the 1969 nesting season indicates 123 nests were located and from this 535 eggs were laid. From this 535 eggs laid, 216 young were hatched. A total of 175 young Canadas were raised to flyers, banded and released. Also, six nests were located off the refuge in cattle pastures adjacent to the Grand Chenier ridge and one nest was located on the western edge of North Island.

### Waterfowl Banding

A waterfowl banding program was started on Rockefeller Refuge in the winter of 1960 and since that time 15,241 birds have been banded. Efforts were directed toward banding waterfowl which played an important role to the hunters in the state.

During the past two years, 4,302 birds have been banded. This includes lesser scaup, mottled duck, mallard, pintail, blue-winged teal, green-winged teal, shovelers, fulvous tree duck, wood

duck, ring-necked duck, Canada geese, blue geese, snow geese, coots, snipe, king rail, clapper rail, sora rail, meadow lark, mourning dove, white wing dove, and brown pelicans.

Post season banding or banding after the waterfowl season has closed usually begins on



During the past two years 4,302 birds were banded on Rockefeller Refuge. Information gained from band returns will contribute to the long range management program for migratory wildlife.

Rockefeller Refuge in January, and continues through March, depending upon weather conditions. Pre-season banding program on mottled ducks has been underway for several years. Mottled ducks do not take readily to bait and are found in large flocks for a short period of time. Flock dispersal takes place usually in late September or early October.

A method has been developed to capture mottled ducks using airboats and floodlights powered by a small generator. This method has been used on Marsh Island during the summer of 1969 and in one night over 100 mottled ducks were banded. This operation is dependent upon water levels which concentrate family groups. By cruising slowly around the shallow marsh impoundments, family groups could be easily spotted with these lights from 75 to 100 yards away. If the approach was slow and engine noise held at a constant pitch the entire brood could be netted.

### Cooperative Canadian Banding

The Louisiana Wild Life and Fisheries Commission sent a representative to Canada in 1968 to band ducks prior to their southward migration.

Louisiana's representative during 1968 was Biologist Larry McNease of the Refuge Division. Larry was a member of a five man crew which worked on Last Mountain Lake and vicinity, Saskatchewan.

During five weeks of trapping 4,625 ducks were banded using recoilless cannon net traps. The nets were fired a total of 30 times in 27 days, averaging 154 ducks banded per shot. The largest shot scored 664 ducks and the smallest shot produced 17 ducks.

The recovery of banded birds at a later date will provide valuable information that will be used in the overall management objectives for our continental waterfowl population.

### Exotic Waterfowl Study

The objectives of this project is to investigate the possibilities of establishing a non-migratory flock of yellow-billed pintails, *Anas georgica* and Brazilian teal, *Amazonetta brasiliensis* in Louisiana. The four million acres of coastal marshland in Louisiana provides wintering habitat for approximately 5,000,000 ducks and 450,000 blue and snow geese. However, only one species, the mottled duck, uses this vast acreage as a year round residence even though much of this area is suitable waterfowl nesting habitat. The mottled duck does very well in Louisiana and has been a real important bird in the hunter's bag. Population fluctuation seems to be largely dependent upon rainfall during the nesting season.

There are several niches in the coastal marshes that the mottled duck seldom occupies, such as the de-watered marsh now converted to cattle pastures and the deep tall grass fresh marshes. Perhaps the pintail and teal would fit into these places.

Very little work has been done on the feasibility of establishing a non-migratory variety of waterfowl in Louisiana. However, with the extensive home range and territories of the mottled duck, it seems feasible at this time that an additional nesting bird would not adversely effect the mottled duck population. A considerable amount of work has been done by U. S. Fish and Wildlife Service in foreign countries investigating the native species of waterfowl which would be suitable for releasing in the United States. Acting on recommendations of Dr. Gardiner Bump, research biologist for the Bureau, Louisiana selected the yellow-billed pintail and Brazilian teal as possible introductions.

Fifty yellow-billed pintails were received on July 30, 1968 and on September 10, 1968, 20 Brazilian teal were shipped to Louisiana from Buenos Aires. These birds were held in four flying pens and were fed hen scratch with a mixture of whole kernel corn.

In an effort to establish a population of yellow-

billed pintails and Brazilian teal in the coastal marshes of Louisiana the following procedures were recommended. First, pen studies were conducted to investigate the general life history of the birds held before releases, such as molt, plumage patterns, number of eggs laid, time of courtship begins, time of nesting, number of young produced, diseases, and hybridization with other birds. Also, to investigate the reproductive potential, desirability as a game bird and the competition between the exotic species and our local mottled ducks. If after a complete study has been made on these two species and have been found suitable for releasing into the wild, it would then be recommended at this time to obtain a suitable number of breeding pairs. Additional birds should be obtained as soon as they become available and have proven themselves.

The releases are to be of two types. One, the fly-out, the young birds are to be released in open type enclosures which exclude ground predators. These young will then move out into the nearby surrounding marshes and return to the pens where food and water is made available to them. This type of release is now being employed with the fulvous tree duck here on Rockefeller Refuge and has proven very successful. A small non-migratory population of tree ducks has been established here on the Grand Chenier area.

The direct release, release a sizeable number of young birds in a pre-determined release site, Foster mothers, such as domesticated mallards will be released with these young birds. Releases should be made just prior to the flight of the young birds. Egg production could be increased by removing the first clutch of eggs from these birds and placing them in incubators and also under foster mothers, such as farm mallards and silky bantams.

These birds have been kept in captivity in the flying pens at Rockefeller, since they were obtained in 1968. The Brazilian teal, is a little larger than the blue-winged teal and according to the literature should fit into the niches similar to the wood duck. However, this bird is suspected of being a ground nester and should in no way compete for nesting habitat with the wood duck. However, if this bird is a cavity nester and should compete with the wood duck for nesting dens, then additional birds would be sought which could better fit this ecological niche.

The yellow-billed pintail is a bird which prefers the open marshes similar to those of Southern Louisiana and would fit into niches similar to those of mottled duck. However, at this time it is felt that there would be no conflict between the yellow-billed pintail and the mottled duck. Plans for these two exotic species of waterfowl will be continued. Additional pen studies are planned and also efforts will be directed towards building a captive population suitable for study and releases.

## Brown Pelican Study

Brown pelican, Louisiana's state bird, has virtually disappeared from Louisiana's coast and in 1968 a study was begun to determine the cause of their demise and efforts started to re-establish a state population with birds imported from Florida. Records indicate that the last nesting attempt of brown pelicans in Louisiana occurred on North Island, part of the Chandeleur Chain in 1961, when observers reported some 200 adult birds and 100 nestlings. In 1962 only a few adult birds were seen on the islands and no nesting was reported.

In 1968, representatives of various state game departments, Bureau of Sports Fisheries and Wildlife, the Audubon Society, and a number of private organizations met at Rockefeller Refuge to determine past and present population trends and to investigate the possibility of establishing a resident colony of brown pelicans once again in Louisiana. As a result of that meeting, all of the southern coastal states are today actively participating in cooperative programs involving the species.

As an outgrowth of the meeting, plans were made to ship 50 fledgling young pelicans from Florida and release in Louisiana and in July, 1968 personnel of the Refuge Division, Louisiana Wild Life and Fisheries Commission with the aid of the Florida Game and Fresh Water Fish Commission obtained 50 fledgling young pelicans from Cocoa, Florida.



Biologists are conducting research with Brown Pelicans in an attempt to re-establish a colony of Louisiana's state bird.

The birds were trucked to Rockefeller Refuge, Grand Chenier and released in two covered flying pens. Diets and methods of handling were worked out with the aid of the personnel of the Herman Park Zoo, Houston, Texas and Mr. John Lynch, Biologist, U. S. Fish and Wildlife Service.

Plans for the captive flock were two-fold. First,

to investigate the possibilities of establishing a captive population of pelicans that would be available for experimental purposes and second, direct releases of young birds were planned.

Two sites were chosen for releases, the Marine Laboratory, Grand Terre Island and Rockefeller Refuge, Grand Chenier. Both areas once supported large flocks of pelicans on the beaches and surrounding marshes and bay areas of Grand Terre Island provided ideal nesting habitat.

The first release was made in September of 1968, with 25 banded birds set free on Grand Terre. Of the 25, 15 were released as free flyers and the remaining 10 were wing-clipped. It was hoped that by holding some of the birds flightless, the free flying birds would be induced to remain in the general area. Food in the form of small mullet, croaker, and shad was offered in the hope that the flyers would return daily to feed and rest with the wing-clipped flock. In October of 1968, a release of 15 free flyers and six wing-clipped birds was made at Rockefeller. In July of 1969, 25 additional fledgling pelicans were released on Grand Terre and after several weeks all were flying and had joined the other birds. They had learned to forage for themselves and are apparently thriving.

The 1968 release at Rockefeller did not fair out so well; however, falling victim to a mysterious die-off. Sick and dying birds were noticed on the feeding sites last March and were immediately taken to the Veterinary Science Department at Louisiana State University for post-mortem examinations. All dead birds were analyzed at Louisiana State University Feed and Fertilizer Lab for possible chlorinated hydrocarbons insecticide residue.

The result of the analysis from the Veterinary Science Department indicated little which seemed to be of major significance although the birds were emaciated and showed the presence of ascarid endoparasites. Occurrence of the parasites were believed to be relatively normal.

Insecticide residue, however, proved to be another story. Relatively high concentrations of chlorinated hydrocarbons were found in the tissues of the brain and liver in all birds analyzed from the Rockefeller release. According to the findings, tissue samples contained quantities of DDT, DDD, DDE, dieldrin and endrin.

The samples taken in Grand Terre where the pelican colony continued to thrive were relatively clean of insecticide content.

The die-off of Rockefeller birds was spread over a period of approximately one month, indicating that disease that would have resulted in spontaneous die-offs was not the culprit.

The intake of stored fat on the other hand would have been different for each bird resulting in the staggered death toll. Additional birds were obtained last July, 1969 and released on Rockefeller Refuge in order to see if a similar

situation occurs. The inquiry of the fate of the Louisiana brown pelican population is still in its infancy and only general assumptions and trends can as yet be drawn. Preliminary results, however, do help to shed new light on some of the causative agents involved in the bird's disappearance from Louisiana's marshes and beaches.

## Exotic Deer Study

For the past several years, the fallow deer and sika deer have been held in experimental pastures on Rockefeller Refuge to evaluate these two species as possible introduction into Louisiana. The sika deer, from Eastern Asia, has done well on the coastal areas of Maryland and Virginia and plans have been made to develop a breeding population in captivity for possible releases on experimental basis at a later date in Louisiana. The fallow deer of Central Europe has already proven itself on a limited scale in Western Louisiana. This deer has become established on one area; however, it is a privately owned tract of land and this animal is not subjected to hunting pressure.

Reproduction has been attained from the two species in the experimental area on Rockefeller Refuge. However, under the conditions of the planned release, the sika deer seems to be more favorable. This animal has proven to be very seclusive and preliminary results indicate it would make a fine game species. Efforts are being directed towards the establishment of a reasonable number of animals which would be suitable for release.

Marsh Island, an 82,000 acre refuge located in Vermilion Bay, has been selected as a possible release site. Under these conditions, the animals could be studied and could not escape and in no way provide competition for the local white-tail deer herds.

## Oil Pollution

In an effort to determine the effect of one instance of industrial pollution on marsh soils, composite soil samples were taken in a five-acre area on the Marsh Island Refuge that had been affected by pollution from an oil well. The samples were divided into sub-samples at intervals of two inches, labeled, and submitted to the Louisiana State University Agronomy Department for analysis.

Samples were taken in the *Juncus-Spartina* plant community to the north of the polluted area to serve as controls and samples were also taken along a transect line running through the center of the polluted area.

Laboratory analyses were run to determine the concentrations of phosphorus, potassium, calcium, magnesium, sodium, pH, and per cent soluble salts.

Concentrations of phosphorus were much lower in all of the samples analyzed in the polluted area as compared to the control samples. The pH was more acidic in the control area with pH being practically neutral in the polluted area. Concentrations of soluble salts were considerably higher in the scalded area. Concentrations of sodium were much heavier in all three sampling depths for the polluted area. Concentrations of calcium was substantially higher in all of the samples in the polluted areas as compared to the controls. The concentration of calcium was drastically greater in the top two inches of the polluted area. Concentrations of potassium and magnesium were comparable in the polluted and control areas.

In addition to the variations in soil nutrients determined for the polluted vs. control areas, the heavy plastic-like residue that was deposited on the marsh surface would definitely seem to prohibit plant growth.

### Catfish Culture in Brackish Water

Until the studies were initiated, the production of freshwater fish in brackish or saline waters on an experimental basis had not been tried before. Since word of these studies has spread persons located along the coastal portions of the state have expressed interest in catfish culture and have asked advice as to their possibilities. Also, the Commission has been able to give advice

to inland farmers having varying amounts of salt in their water supply.

The first brackish water pond study was begun in April of 1967, when blue, channel and white catfish were obtained from freshwater hatcheries and stocked in saline ponds. The objectives of the study were to determine growth, survival, food conversion and to determine if freshwater catfish could be raised in brackish water ponds. Each of the species were placed in separate 0.1 acre ponds at a stocking rate of 2,000 per acre. The fish were initially fed a sinking ration at 10 per cent body weight; later feeding was dropped to the standard 3 per cent.

Growth was good for all species even though the salinities ranged from 2.0 to 11.0 ppt (parts per thousand). The channel and white catfish grew best, averaging 1.3 and 1.0 pounds apiece. The blues averaged 0.6 pound each. The food conversions were naturally quite high because of poor survival due to predation. The channel catfish had the lowest S-conversion of 3.2, the white had an S-value of 5.8 and the blue catfish's value was 10.1. The mortality rates were approximately twice as high for the blue and white than for the channel.

The study was repeated in 1968 except that the stocking rate was 2,500 fish per acre and a floating feed ration was used. Growth, survival and food conversion followed the same general pattern as reported in the 1967 study, although the fish averaged more in 1967 due to a longer period of growth. The now commercially important



Brackish water fishery research ponds have been constructed at Rockefeller Wildlife Refuge ranging in size from 0.1 acre to 0.25 acre.

channel catfish outgrew the rest averaging 0.8 pound, the white catfish averaged 0.7 pound and the blue catfish averaged 0.6 pound. The channel catfish had the lowest S-value of 2.3, the white had an S-value of 2.9 and the blue had a value of 4.0. Survival was highest for the channel catfish and lowest for the blue catfish.



Freshwater catfish grown in brackish-water ponds at Rockefeller Wildlife Refuge.

The condition indexes, using standard length, calculated for white, channel and blue catfish were 2.15, 1.70 and 1.49, respectively. The length-weight relationships for the pond reared channel catfish was  $\text{Log } W = -5.530 + 3.196 \text{ Log } L$ , blue catfish was  $\text{Log } W = -7.566 + 3.985 \text{ Log } L$ , and the white catfish was  $\text{Log } W = -5.487 + 3.237 \text{ Log } L$ . The  $R^2$  values were 0.998, 0.999 and 0.995, respectively.

These studies indicated that these fish may be successfully grown in coastal waters which will not exceed 8.0 ppt salinity for an extended period of time. Though these fish will tolerate up to 11.0 ppt it is felt that this is not conducive toward optimum growth. Both the white and channel catfish survived exceptionally well during the study period under conditions of hot weather, muddy water and low oxygen concentrations. The channel catfish seemed to be the most hardy of the three species contrary to common belief, and probably would give the best returns to future fish farmers in coastal areas for one or two years growth. However, it is possible that the blue catfish will surpass the others in its second or third year. And, if larger fish are desired this species should be considered. The white catfish, possessing features common to channel and bullhead catfish, might be harder to sell to the public. Though the flavor is thought equal, or superior, to the others it is thought of as trash fish to those unfamiliar with it. Also, some of the white catfish that have reached 2.5 to 3 years of age seem to be developing an unusually large head in proportion to their body size.

## Crawfish Culture in Brackish Water

Crawfish are utilized as a food and recreational resource in Louisiana to a much greater degree than any other state. Though the annual crawfish harvest varies from 6 to 10 million pounds the supply has not satisfied the demand since 1965. The availability of land suitable for economically feasible crawfish farming is limited. The purpose of this study is to determine if the red swamp crawfish could survive and reproduce in brackish situations since there are several thousand acres of marshlands that possess a potential if the water salinities are not harmful.

The initial field experiments were begun in 1967 in cooperation with Mr. Cecil LaCaze, Fish and Game Division with the stocking of an ex-



Fertile female crawfish were placed in glass jars, each containing different salinity concentrations, in an effort to determine the maximum concentrations in which they could reproduce.

perimental 5.6 acre pond. The pond was stocked at a rate of 89 pounds per acre. Population samples taken in the fall of 1967 and the fall of 1968 correlated with the monthly salinities recorded during the study indicated that the crawfish bred in waters containing maximum salinity concentrations ranging from 6.0 to 8.0 ppt. The hatching of eggs took place in maximum salinity concentrations ranging from 6.0 to 7.9 ppt. Crawfish growth was evident in waters in which monthly salinities ranged up to 8.0 ppt. A minimal harvest of 1,525 pounds or 272 pounds per acre was calculated for the period.

A bio-assay was set up with female crawfish

in an effort to determine the maximum salinities that young embryos could tolerate under controlled conditions. Fertile female crawfish were placed in glass jars, each containing salinity concentrations ranging from 1.7 to 14.0 ppt. Records were maintained for beginning and ending water salinity, number of young and day of hatching. Some hatches had occurred at the time of this report but the results are too incomplete to make any definite statements at this time.

### Crawfish-Waterfowl Management Study

It is apparent that the marshlands of Southwest Louisiana are gradually being changed into areas void of wildlife. The state no longer has the massive nursery grounds that it once had for sport and commercial fisheries and each year it is found that the vast wetlands that are so very important to fur-bearers and wintering waterfowl are decreasing.

It is certain that more coastal wetlands will be created and preserved if marshland owners could get some assurance of added profits from some multiple usage of their lands (duck leases, trapping, crawfish harvest, etc.). It is the intention of this project to compile and evaluate the potential of the brackish-to-freshwater marshes for crawfish-waterfowl management. It looks very promising since the management techniques of the two closely coincide.

Several of the brackish-to-freshwater waterfowl impoundments at Rockefeller are being followed for crawfish production. Such limnological data as salinity, temperature, pH and water depth are recorded along with harvest data.

This is the first year of the study and harvest data will not be included in this report.

### Croaker Culture

Although croakers are important as food fish in some areas it is not regarded as such in other areas. In Louisiana most croaker caught by shrimpers and commercial fishermen are too small to sell for food. A large percentage of Louisiana's croaker harvest is sold to pet food producers for approximately \$3.00 per hundred pounds. This market is only for juvenile croaker. Perhaps with a constant high quantity supply of larger fish and favorable publicity, as was done with shrimp, the market could be increased. The Atlantic croaker, *Micropogon undulatus*, one of the most abundant fish in the Gulf of Mexico, was the initial species studied.

In April of 1966, croakers were stocked in six 1/3-acre brackish water ponds for a L.S.U. graduate student's problem course. The student was not able to maintain a constant personal surveillance of the ponds and most of the feeding and pond maintenance was left to refuge employees unskilled in pond management. The fish were

harvested 258 days later. Total numbers and weights were determined for each pond to obtain production per acre and survival. The results of this study were reported in the 1966-67 biennial.

The experiment was repeated in a 1968 cooperative study with Dr. James Avault, assistant professor, Louisiana State University, when juvenile croaker were stocked in six 0.1 acre brackish water ponds at rates of 500, 1,000 and 2,000



Since 1966 several marine fish species have been tested for their mariculture potential. The Atlantic Croaker, *Micropogon undulatus* one of the most abundant fishes in the Gulf of Mexico was the initial species studied.

per acre. The fingerling croaker (approximately 3/4 inch total length) were obtained by trawling in the Gulf of Mexico.

Growth and survival of the 1968 study were somewhat better with production per acre ranging up to 300 pounds (Table 3). Survival ranged from 0 to 94 per cent.

Stomach contents were compared to food available to the fish. A preference for grass shrimp over fishes was indicated, as expected.

All of the pond reared croakers were sexually mature when approximately one year old as both eggs and sperm flowed freely while the fish were being weighed and measured. The weighted condition factor " $K_t$ " of the 1968 pond reared croakers, based on 362 fish, was 1.36. The formula obtained for the length-weight relationship of these fish was  $\log W = -5.2498 + 3.1652 (\log L)$ .

The growth obtained by these pond reared fish was obtained almost entirely on natural foods. Experiments are currently underway in order to determine if supplemental feeding is justifiable in the production of a larger harvest and to determine if these fish can overwinter in ponds.

**Table 3**  
**GROWTH AND SURVIVAL OF CROAKER IN 0.1 ACRE BRACKISH**  
**WATER PONDS. PONDS WERE STOCKED MARCH 19, 1968 AND**  
**DRAINED OCTOBER 30, 1968 (225 DAYS)**

| <i>Pond number</i>               | <i>B-30</i> | <i>B-31</i> | <i>B-32</i> | <i>B-33</i> | <i>B-34</i> | <i>B-35</i> |
|----------------------------------|-------------|-------------|-------------|-------------|-------------|-------------|
| Numbers stocked .....            | 200         | 200         | 50          | 100         | 100         | 50          |
| Weight (g) .....                 | 660         | 660         | 165         | 330         | 330         | 165         |
| stocked (lbs.) .....             | 1.45        | 1.45        | 0.36        | 0.73        | 0.73        | 0.36        |
| Average size stocked (g) .....   | 3.3         | 3.3         | 3.3         | 3.3         | 3.3         | 3.3         |
| Number recovered .....           | 50          | 116         | 47          | 71          | 78          | 0           |
| Weight recovered                 |             |             |             |             |             |             |
| (g) .....                        | 9,470       | 13,625      | 6,539       | 7,680       | 10,642      | .....       |
| (lbs.) .....                     | 20.9        | 30.0        | 14.4        | 17.0        | 23.5        | .....       |
| Average size recovered (g) ..... | 189         | 117         | 139         | 108         | 136         | .....       |
| Survival percent .....           | 25          | 58          | 94          | 71          | 78          | 0           |

### Pompano Studies

In the summer of 1968 pompano were collected from gulf waters and stocked in one-tenth acre ponds on Rockefeller Refuge to determine survival, growth, food conversion and to determine their general desirability as a pond reared fish. In this initial test both survival and growth of pompano in our ponds was poor. This could have been due to (1) low salinity, (2) low water temperature, (3) extremely high summer temperatures, (4) predators, (5) oxygen depletion, (6) short food supply, and (7) parasites. Survival was best in ponds containing vegetation which may have offered the fish cover from predators.

Pompano have a very high metabolic rate (rate at which food is converted to energy) and as a result they are constantly in search for food. In ponds and aquariums we have fed rations of floating catfish chow, floating trout chow, fish meal and ground fish. In all instances it was noted that the fish adjusted rapidly to the rations. However, none of these produced the growth needed, probably as a result of extremely low water salinities (less than 3.0 ppt in all ponds). It has already been stated that the fish are very active. Because of this, it is felt that a high protein ration will be essential and possibly some form of water circulation will be necessary to keep oxygen content up and to prevent waste build up in the pond. We have collected our fish from the beaches for our experiments, but in the future it will be necessary to spawn these fishes in captivity as is done with catfish and other commercially reared species.

A bio-assay was conducted with pompano collected from Rutherford Beach in order to determine the effects of temperature and salinity changes upon survival. Six aquariums contained pond water (1.6 ppt, 64° F.) and six contained the water from which they were collected (21.8 ppt, 74° F.). Five fish were placed in each tank. The small pompano exhibited an uncoordinated spinning effect when put in the cool, low salinity tanks but all regained equilibrium and were feed-

ing aggressively in about 30 seconds. All tanks were fed the same ration approximately 6 times daily and were placed in a room in which the temperature was relatively constant. Constant



Pompano, the luxury fish of Louisiana, has been selected for study at Rockefeller Wildlife Refuge. Growth data are obtained from all fish reared in research ponds.

surveillance revealed that after 12 hours the fish held in the low salinity aquariums were in poor shape with only 50 per cent survival. This trend held constant until 96 hours had past. At this time the fish in the low salinity experienced an-

other 50 per cent drop in survival resulting in an overall survival of 20 per cent. The fish held in the original water had a survival of 96.7 per cent at this point.

Four floating baskets approximately 3' X 3' X 3' were constructed using 2 X 2 inch pine for the frame. The cages were walled with 1/4 inch nylon webbing. Pompano were stocked into the baskets and placed in a tidal canal. Commercial fish flakes were fed to pompano in addition to the natural foods available. The fish in all cages did exceptionally well for approximately six weeks. At this time, crabs on the outside of the cages cut the nylon apparently trying to get to the waste feed allowing the fish to escape. The basket culture study will be repeated next spring. It is believed that these basket reared fish will be able to forage on natural foods, avoid a waste buildup which is frequently present in highly fed ponds and will avoid low oxygen situations which are often present in our small marsh ponds.

## Shrimp Culture

An experiment was conducted during the summer of 1969 to determine if shrimp could be stocked and raised in coastal ponds by simply flowing water through these ponds. Water was slowly pumped through one of the 0.1 acre ponds beginning in mid-July. Fourteen weeks later the pond was drained because predicted low temperatures were feared to be fatal to the shrimp. The following is a list of the species taken from the pond.

### Pond B-7, Salinity Range 4.7—13.2 ppt.

| Species                            | Total Length mm. | No. | Weight (lbs.) |
|------------------------------------|------------------|-----|---------------|
| <i>Chaenobryttus gulosus</i> ....  | 135-155          | 34  | 4.6           |
| <i>Mugil cephalus</i> .....        | 190              | 2   | ..            |
| <i>Menidia beryllina</i> .....     | 90-95            | 14  | ..            |
| <i>Mollienesis latipinna</i> ..... | 25-35            | *   | ..            |
| <i>Procambarus clarkii</i> .....   | 65-90            | 7   | ..            |
| <i>Penaus fluviatilis</i> .....    | 130-165          | 89  | 5.4           |

The white shrimp were uniform in size and had reached a size of 16 count. It is remarkable that the harvest was as good as it was (54 pounds per acre), since it is certain that the warmouth sunfish, *Chaenobryttus gulosus*, made serious inroads upon the shrimp.

## Shrimp-Waterfowl Management Study

More and more, landowners are trying to get maximum yields from their lands. Unfortunately, this has lead to the gradual draining, channelization, and drying of many acres of prime coastal wetlands. It is an established fact that these

lands are not only valuable for wintering waterfowl, but also, for the bulk of marine fish and shell-fish populations as a nursery area.

If landowners could get some assurance of future monetary returns from their lands it is certain that more coastal wet lands would be created and preserved. It is very possible that shrimp can be harvested annually from many of our brackish coastal lands and it is the intention of this study to develop management techniques that will coincide with waterfowl management. Thus, a land owner could expect an annual income from shrimp, crabs, fur animals, waterfowl leases, etc.

Even though Louisiana does not experience the extreme tidal fluctuation common to the coastal eastern states we have been able to stock our study area as Dr. Lunz has described for South Carolina. That is by permitting the post-larval stages to drift with the current into the ponds. The shrimp in the study were not fed but were allowed to forage entirely for themselves upon natural foods.

Additional research is necessary before any definite recommendations can be made concerning a shrimp-waterfowl combination. However, two year's data give support to the fact that it can be done.

## Seasonal Distribution of Fishes

The primary objective of this study was to obtain an inventory of the fishes and to determine their seasonal movements. A second objective is to interpret these seasonal changes in relation to limnological conditions.

Fish collections were made twice each month at Joseph Harbor and at stations set up at Ruth-erford Beach, Holly Beach and Sabine Lake. The samples were taken at Joseph Harbor with a 16-foot 3/4 inch mesh otter trawl towed at 10-minute intervals. The samples were collected at the other stations with a 40-foot by 1/4 inch by 6 foot bag seine. Standard length, total length and weight were recorded for the fish. Such data as salinity, pH, temperature and tide condition were obtained at each sample site.

## Fish Tagging Studies

Approximately 2,000 native channel and blue catfish have been captured, tagged and released in an effort to better understand the habits and requirements of these freshwater fish dwelling in the brackish waters of Southwest Louisiana. The information gained from this study will supplement that obtained from brackish water pond culture studies presently underway at Rockefeller Refuge.

Two very impressive returns obtained involved channel catfish tagged during October of 1968.

One was released three miles north of Deep Lake, Grand Chenier, La. and was caught by a fisherman seven months later at Lowry Point near Lake Arthur, La. over 40 miles from the refuge. The other released at the same place was caught on the Mermentau River over 30 miles from its release site eight months later.



Red Snapper have been caught, tagged and released in an effort to learn more of their life history.

During the summer of 1969, one hundred and twenty-four red snapper were caught, weighed, measured, tagged and released in an effort to learn more of their life history. Seven tag returns have been reported by snapper fishermen. The fish had not moved from the vicinity in which they were released and the tags were holding up well.

### Freshwater Fishing Impoundments

An 80-acre freshwater impoundment located along Superior Canal was set up for public fishing. The pond was drained to the basin and the remaining water poisoned in the spring of 1968. A small pumping unit was set up and freshwater was pumped into the pond. Bass, blue gill, red-ear sunfish, and catfish were obtained from a state hatchery and stocked in 1969. Seine samples indicate the bluegill and redear sunfish have spawned and the bass are developing excellently. The pond will not be opened to fishing until the summer of 1971.

### Marsh Island Fisheries Research

Research continued at Marsh Island in an effort to determine the comparative value of semi-impounded Louisiana tidal marshes as nursery areas for fishes, shrimp and crabs. Mr. William H. Herke, assistant leader of the Louisiana Cooperative Fishery Unit, was in charge of the project. Collection of field data was completed and all of the organisms were identified, measured and weighed. Length-frequency and length-weight relationships are presently being determined. The Marsh Island data will be compared to data taken for the same period from the Biloxi Wildlife Management Area. The final analysis will be completed during 1971.

Two studies serving as graduate thesis projects were carried out on Marsh Island in cooperation with the Louisiana Cooperative Fishery Unit. The abstracts of these studies follow.

### OTTER TRAWL AND BENTHIC STUDIES IN AN ESTUARY AT MARSH ISLAND, LOUISIANA

Otter trawl samples were taken at eight lagoons monthly from March through September, 1968, at Marsh Island, Louisiana. Number and biomass composites indicated three communities of fishes and crustaceans during the study period. Based on community structures, three habitats were inferred which corresponded to the three communities: unweired, weired non-vegetative, and vegetative. By number, *Penaeus setiferus* was predominant in the unweired community, *Leiostomus xanthurus* was predominant in the weired non-vegetative community, and *Palaeomonetes* sp. was predominant in the weired vegetative community. By weight, *Mugil cephalus* was predominant in the unweired community, *Leiostomus xanthurus* was predominant in the weired non-vegetative community, and *Lepisosteus spatula* was predominant in the weired vegetative community. Salinity, turbidity, and temperature data were used to help characterize the habitats. Salinities were slightly higher in the weired habitats, while turbidities were generally lower in the weired vegetative habitat and higher in the unweired habitat.

The food habits of the major fishes in the communities were examined. Organic detritus and benthic macroinvertebrates (mostly chironomidae) represented the highest percentage in stomachs examined and were inferred to be the predominant energy sources utilized by the major species of the unweired and weired non-vegetative communities. Of these two, organic detritus was the most important source of energy based on food habit studies. Benthos, vascular plants, and zooplankton were the predominant energy source utilized by the major species of the weired vegetative community.

Estimates were made of the amounts in some sources of organic energy that were potentially available to fishes and crustaceans. Chironomidae larvae were the most abundant in faunal macroinvertebrates taken in benthic samples during June, July, and August, 1968. Detritus and fine sized organic particles were the most abundant sources on the bottom.

This work was conducted by Louisiana State University graduate student James Weaver.

### SURFACE TRAWL AND PLANKTON STUDIES IN AN ESTUARY AT MARSH ISLAND, LOUISIANA

Surface-trawl samples from March through September, 1968, on Marsh Island, Louisiana

showed differences in community structures of macroinvertebrates and vertebrates among unweired non-vegetative, weired non-vegetative, and weired vegetative areas. The community structures by number and weight composites indicated that two different trophic systems and energy-flow mechanisms were operating during the study period. In unweired and weired non-vegetative areas, most of the energy which passed into the macroinvertebrate-vertebrate level was partitioned into *Brevoortia* sp., *Anchoa* sp., and *Micropogon undulatus*. Plankton tow samples indicated that most of this energy was probably from organic detritus with minor portions from zooplankton and phytoplankton.

Most of the energy in the macroinvertebrate-vertebrate level in the weired vegetative area was partitioned into *Mollienesia latipinna*, *Palaeomonetes* sp., and *Lucania parva*. Periphyton probably provided much of the energy for most of the vegetative area organisms in the macroinvertebrate-vertebrate level.

Organic detritus was the most conspicuous segment of the materials collected in plankton tows from all sample sites during June, July and August, 1968. Zooplankton was very sparse during these months.

A small amount of physical and chemical data from the lagoons was used to help define habitat types. Mean weekly water temperatures varied little between the weired and the unweired areas. Salinities for all areas decreased monthly from approximately 9 ppt during March to approximately 1 ppt during September. Weired lagoons were slightly more saline than unweired lagoons during the study. Relative turbidities were generally lowest in the weired vegetative area and highest in the unweired area.

This work was conducted by Louisiana State University graduate student Luther Holloway.

## COOPERATIVE STUDIES

In addition to the research projects carried out by the Refuge Division, the division also cooperated with several other agencies in ecology studies on the refuges. In addition to financial assistance, the Refuge Division provided overnight lodging accommodations, lab facilities, library facilities, equipment, equipment maintenance and supplies, and technical assistance.

Cooperators in this research work were the Louisiana Cooperative Wildlife Research Unit, Louisiana Cooperative Fishery Unit, and Louisiana State University. Participating departments at L.S.U. were the School of Forestry and Wildlife Management, Agricultural Engineering, Botany Department, and the Agricultural Experiment Station.

Research information extracted from Louisiana Cooperative Wildlife Research Unit Reports and from student theses, are included below so that

the highlights of these cooperative projects can become a permanent record of this biennial report.

## Breeding Behavior of Mottled Ducks

From September, 1966, to September, 1968, a study of the breeding behavior of mottled ducks (*Anas fulvigula maculosa*) was conducted at Rockefeller Refuge, Grand Chenier, Louisiana. The study was conducted by Jack Weeks through the Louisiana Cooperative Wildlife Research Unit.

Courtship and pairing began during August. Courtship displays resembled those described for



Radiotelemetry equipment was used to determine the home range size of mottled ducks on Rockefeller Refuge.

the mallard (*Anas platyrhynchos*). Ninety per cent of the ducks were paired by February. Sex ratio during the courting period was 1.5 males per female. Small ponds and water areas between wiregrass islands were used for courting.

Cross-pairing between mallards and mottled ducks made up only 1 per cent of all pair observations. This low incidence of cross-pairing apparently occurred, in part, because mallards paired later than most mottled ducks.

Territorial behavior, beginning in late February and early March, tended to space nesting birds.

Home range size of four ducks was determined by radio-telemetry and ranged from 105 to 327 acres. Home ranges may have been underesti-

mated because of short transmitter life and optimal water conditions in the study area.

Carrying capacity of homogenous wiregrass habitat was low and may be increased by level ditching or by pothole blasting.



Artificial incubators are used for the hatching of various waterfowl species, such as the Fulvous Tree Ducks pictured above.

### Wiregrass Control Studies

*Short Term Effects of Various Control Measures on Undesirable Vegetation in a Salt and a Fresh Marsh.* A study was conducted on and adjacent to Rockefeller Refuge, Grand Chenier, Louisiana, from September, 1966 to November, 1968. The study was conducted by George Chandler, with the Louisiana Cooperative Wildlife Unit. The objectives were to measure and evaluate the results from a series of experiments designed to improve the vegetative composition of marshland to make it more desirable for wildlife and cattle. These experiments involved reduction of stands of undesirable vegetation to favor the growth of more desirable plants. Areas in both the salt marsh and fresh marsh received the treatments which included tilling, burning, chemicals and the various combinations of these.

In the fresh marsh the till treatment significantly reduced wiregrass; however, the interactions of burning and tilling was most effective in reducing wiregrass. The till treatment also was the most effective treatment in production of desirable plants. The salinity range was from 505 ppm to 2240 ppm. The water levels ranged from -2.0 inches to 15.0 inches.

In the salt marsh tilling reduced both wiregrass and saltmarsh grass. Tri-fen decreased the number of stems of saltmarsh grass, but till plus Tri-fen was more successful in reducing the number of stems. Burning increased number of stems of saltmarsh grass. No treatments in the saltmarsh were successful in increasing leafy three square sedge. The range of salinities encountered in the salt marsh was from 1380 ppm to 9217 ppm. The water levels ranged from 5.00 inches to -2.25 inches.

*Vegetative Reinvasion of Experimentally Treated Plots in a Brackish Marsh.* From September, 1966, to February, 1968, a study was conducted in the Price Lake area of Rockefeller Refuge, Grand Chenier, Louisiana. Its goals were to study the effectiveness of tilling, burning, application of chemicals and a combination of burning, tilling, and chemicals in retarding the growth of wiregrass (*Spartina patens*) and saltmarsh grass (*Distichlis spicata*). Also, the objectives were to evaluate the usefulness of wet weight as a reliable measure of vegetative abundance, and to find a prediction equation in saline marsh for salinity based on water level.

Burning and tilling significantly reduced the growth of wiregrass and saltmarsh grass. The combination of burning and tilling was most effective in reducing the growth of these undesirables. Burning and tilling allowed leafy three-cornered grass to successfully re-invade the plots.

The use of any of the chemicals was more effective in eliminating wiregrass and saltmarsh grass than in treatments where no chemicals were used. Fenuron was found to be the most effective in retarding the growth of saltmarsh grass; however, it significantly retarded the growth of leafy three-cornered grass. Bromacil was more successful than Karmex in reducing the undesirables, and it also allowed the best growth of leafy three-cornered grass.

In general, best growth occurred in all species from May through October with a general decline from November through April.

An extremely small coefficient of determination and a non-significant regression coefficient was found in the regression of salinity on water level. No prediction equation was formulated.

Dry weight was found to be the most reliable measure of vegetative abundance. Significant relationships were found between dry weight and wet weight and between dry weight and number of stems. The measure of wet weight was found to be unreliable for comparisons among samples.

This study was conducted by David Soileau and was a follow-up study of the project begun in January of 1965.

### Snipe Study

The study begun by Wade Hoffpauer under the Louisiana Cooperative Wildlife Research Unit in the fall of 1967 was completed during this report period.

The objectives of this study were to determine a practical method of aging and sexing snipe by plumage characters and to evaluate and develop practical methods from trapping snipe.

Results of discriminant function analyses for sex and age indicated that bill length, middle-toe length, tarsus length, and weight cannot be used to accurately age or sex snipe.

No single feather measurement could be used to accurately age or sex snipe because the chances of misclassification were too great. Therefore, a discriminant function analysis was run for the ten measurements with the least amount of overlap between the two distributions in the order of their importance for age and sex. The least amount of overlap (2.78) per cent) for sexing involved six feather measurements, while the least amount of overlap (12 per cent) for aging used the four best feather measurements. If the predicted overlap was representative of the population, this method of aging and sexing snipe could be practically used for banding purposes.

Ground traps and night-lighting showed little promise as productive trapping methods. The cannon net could be effective, but only under rather restrictive conditions. Mist nets proved to be the most practical and productive trapping method evaluated. Mist nets set in zig-zag patterns, across the wind, and so that the bottom rested on the ground performed the best. The ideal number of nets for two workers was 25 for a weekend operation. The best weather conditions in which to catch snipe were clear, bright days during dry periods in January, February, and March. Most snipe were caught between 6:00–10:30 AM and 2:00–6:00 PM. The most productive areas were grazed, wet pastures where concentrations of snipe had been observed.

### **Ecological Factors Affecting *Echinochloa Walteri*, *Panicum Dichotomiflorum* and *Leptochloa fascicularis***

A study of the ecology and management of millet, fall panicum, and sprangletop which was begun in the summer of 1967 was continued through 1969. David Soileau was assigned to the study with John Newsom and Charles Schexnayder as co-supervisors.

The objectives of the study are: (1) to determine the factors affecting natural and artificial stands of millet, fall panicum, and sprangletop, (2) to develop methods of propagation under experimental and natural conditions, (3) to evaluate the effects of competition from other plants on growth and seed production, (4) to measure animal depredation and its effects on stand density and seed yield.

Tank studies were initiated at Louisiana State University using water of 0, 3, 6, 9, 12, 15 and 18 ppt salinity and varying water levels for seedlings of each of the three plant species under investigation. Data collected from this phase of the study will be analyzed to determine optimum water level and salinity for maximum vegetative growth and seed head production.

Field studies were begun in the spring of 1968. Study areas were established on which intensive soil, water, plant, and animal interactions will be evaluated.

### **Three Cornered Grass Study**

A study begun by Angelo Palmisano in June of 1965 was further continued to determine ecological factors affecting the establishment, growth, and propagation of three-cornered grass and leafy-three square. The study was conducted through the Louisiana Cooperative Wildlife Research Unit and Louisiana State University with John Newsom and Clair Brown as co-supervisors.

In addition to supplementing the findings reported in the previous biennium, work progressed during 1968–69 with major objectives aimed at determining the basic ecological factors influencing the production and growth of natural communities of three-cornered grass and leafy-three square and also at determining the effects of water level and salinity on plant growth under greenhouse conditions.

# Law Enforcement Division



LEONARD NEW  
Chief

**A**N INTEGRAL part of the Louisiana Wild Life and Fisheries Commission, the Enforcement Division consistently strives to maintain the highest possible standards to gain the confidence of Louisiana citizens. Proper and impartial law enforcement is the key to constant improvement of the state's valuable outdoor recreational resources.

In the past two years the division's wildlife agents filed more violation cases than ever before. During 1968 a total of 7,246 arrests were recorded, which was an all-time high. In 1969 a total of 6,600 cases were recorded. Although the total number of cases in 1969 was lower than the year before, the record shows more cases of major importance were made and that a high mark was set with federal migratory cases in 1969. An example was 243 cases filed by enforcement agents during the 1969 special teal season held September 13-21.

Over and above the vital duties of enforcing the fish and game laws, are the countless extra hours utilized in rescue work. The most dramatic example of this took place in August, 1969, when Hurricane Camille devastated south Louisiana and the Gulf Coast. Enforcement agents were alerted days before the hurricane blew its way to shore. After the full force of Camille left its toll of disaster on the shores of Louisiana and Mississippi, agents moved into the stricken areas with cars, trucks, boats and planes. Food, water and medical supplies were immediately dispatched by agents to the survivors. Most of the enforcement agents worked long hours for 30 days in the clean-up operations in Plaquemines Parish. For three weeks, 30 agents were based in Waveland, Mississippi, assisting those on the Gulf Coast. Those extra hours of frequently hazardous duty were never counted by enforcement personnel who volunteered for the rescue and clean up operations because they wanted to give their time.

To maintain the high caliber of men in the division, all new agents are sent to the basic law training school conducted for two weeks at Louisiana State University. Each year two hand-picked agents are sent to a four-month school conducted by the LSU Law Enforcement Institute, where they are trained in all phases of law enforcement.

During the past biennium, the Enforcement Division continued to work with Federal, parish, city and state police, not only in duty concerning game law violations but to assist in the apprehension of other types of lawbreakers.

The Enforcement Division operates a large fleet of outboard motor boats. Nearly all agents are equipped with boats, outboard motors and trailers to be ready to operate anywhere in the state. These boats and vehicles are in touch with headquarters at all times by radio. Besides the small boats there are four larger vessels which can go into any area and operate as base ships, to house and feed personnel.

A breakdown of activities of the Enforcement Division during the past two years follows:

## TOTAL CASES MADE

| DISTRICT I      | 1968 | 1969 |
|-----------------|------|------|
| Bienville ..... | 91   | 63   |
| Bossier .....   | 119  | 81   |
| Caddo .....     | 49   | 89   |
| Claiborne ..... | 74   | 92   |
| DeSoto .....    | 94   | 80   |
| Red River ..... | 18   | 46   |
| Webster .....   | 48   | 27   |
|                 | 493  | 478  |

DISTRICT II

|                    |     |     |  |
|--------------------|-----|-----|--|
| East Carroll ..... | 54  | 43  |  |
| West Carroll ..... | 20  | 42  |  |
| Morehouse .....    | 70  | 110 |  |
| Union .....        | 85  | 99  |  |
| Lincoln .....      | 14  | 8   |  |
| Jackson .....      | 24  | 26  |  |
| Ouachita .....     | 118 | 85  |  |
| Richland .....     | 55  | 78  |  |
|                    | 440 | 465 |  |

DISTRICT III

|                    |     |     |  |
|--------------------|-----|-----|--|
| Natchitoches ..... | 117 | 140 |  |
| Winn .....         | 31  | 37  |  |
| Sabine .....       | 165 | 236 |  |
| Grant .....        | 58  | 57  |  |
| Vernon .....       | 107 | 110 |  |
| Rapides .....      | 111 | 92  |  |
| Avoyelles .....    | 116 | 196 |  |
|                    | 705 | 868 |  |

DISTRICT IV

|                 |     |     |  |
|-----------------|-----|-----|--|
| Madison .....   | 51  | 50  |  |
| Caldwell .....  | 117 | 105 |  |
| Catahoula ..... | 113 | 41  |  |
| Tensas .....    | 257 | 135 |  |
| Franklin .....  | 87  | 81  |  |
| LaSalle .....   | 93  | 120 |  |
| Concordia ..... | 160 | 83  |  |
|                 | 878 | 615 |  |

DISTRICT V

|                   |       |       |  |
|-------------------|-------|-------|--|
| Allen .....       | 124   | 80    |  |
| Calcasieu .....   | 314   | 290   |  |
| Jeff. Davis ..... | 56    | 83    |  |
| Cameron .....     | 412   | 381   |  |
| Evangeline .....  | 87    | 61    |  |
| Acadia .....      | 62    | 57    |  |
| Beauregard .....  | 93    | 73    |  |
| Vermilion .....   | 169   | 128   |  |
|                   | 1,217 | 1,153 |  |

DISTRICT VI

|                        |     |     |  |
|------------------------|-----|-----|--|
| Iberville .....        | 302 | 238 |  |
| Pt. Coupee .....       | 163 | 117 |  |
| West Baton Rouge ..... | 102 | 47  |  |
| Lafayette .....        | 23  | 50  |  |
| St. Landry .....       | 179 | 196 |  |
| St. Martin .....       | 176 | 122 |  |
|                        | 945 | 770 |  |

DISTRICT VII

|                        |       |       |  |
|------------------------|-------|-------|--|
| West Feliciana .....   | 6     | 12    |  |
| East Feliciana .....   | 43    | 32    |  |
| East Baton Rouge ..... | 69    | 46    |  |
| St. Helena .....       | 36    | 29    |  |
| Livingston .....       | 112   | 106   |  |
| Tangipahoa .....       | 148   | 165   |  |
| Ascension .....        | 252   | 147   |  |
| Washington .....       | 174   | 69    |  |
| St. Tammany .....      | 396   | 400   |  |
|                        | 1,236 | 1,006 |  |

DISTRICT VIII

|                   |       |       |  |
|-------------------|-------|-------|--|
| Lafourche .....   | 116   | 134   |  |
| St. Mary .....    | 54    | 72    |  |
| Terrebonne .....  | 178   | 305   |  |
| St. James .....   | 50    | 10    |  |
| St. John .....    | 51    | 61    |  |
| St. Charles ..... | 121   | 129   |  |
| Jefferson .....   | 198   | 100   |  |
| Orleans .....     | 168   | 34    |  |
| St. Bernard ..... | 90    | 90    |  |
| Plaquemines ..... | 92    | 60    |  |
| Assumption .....  | 71    | 80    |  |
| Iberia .....      | 156   | 170   |  |
|                   | 1,345 | 1,245 |  |
|                   | 7,246 | 6,600 |  |



Wildlife Agents in District VI are shown with illegal deer that were seized. Under Commission policy, game confiscated by agents is turned over to a hospital or charitable organization in the parish in which it is seized and a receipt or letter for the donation filed with papers pertaining to the case.



Trawling during closed season in inside waters is a common offense. Shrimp seized from illegal trawlers are carefully refrigerated and donated to charitable institutions. Receipts for such transfers are filed with papers pertaining to the case.

# FINES COLLECTED IN STATE AND FEDERAL COURTS

|                      | 1968<br>State | Federal     | 1969<br>State | Federal     |
|----------------------|---------------|-------------|---------------|-------------|
| Acadia .....         | \$ 68.00      | .....       | \$ 34.00      | \$ 225.00   |
| Allen .....          | 360.00        | .....       | 1,263.50      | .....       |
| Ascension .....      | 2,139.00      | 240.00      | 2,301.00      | .....       |
| Assumption .....     | 57.00         | .....       | 200.00        | 50.00       |
| Avoyelles .....      | 1,211.00      | .....       | 1,660.00      | 240.00      |
| Beauregard .....     | 512.00        | .....       | 325.00        | .....       |
| Bienville .....      | 1,130.00      | .....       | 383.00        | .....       |
| Bossier .....        | 1,427.00      | .....       | 880.00        | .....       |
| Caddo .....          | 628.00        | 200.00      | 600.00        | 500.00      |
| Calcasieu .....      | 509.00        | 1,150.00    | 77.50         | 2,120.00    |
| Caldwell .....       | 1,471.00      | .....       | 986.00        | .....       |
| Cameron .....        | 2,483.50      | .....       | 1,165.00      | .....       |
| Catahoula .....      | 810.50        | .....       | 97.00         | .....       |
| Claiborne .....      | 2,051.50      | .....       | 1,781.00      | .....       |
| Concordia .....      | 1,946.00      | .....       | 3,175.00      | .....       |
| DeSoto .....         | 867.00        | .....       | 796.00        | .....       |
| E. Baton Rouge ..... | 550.00        | .....       | 605.00        | 1,220.00    |
| E. Carroll .....     | 1,304.00      | .....       | 929.00        | .....       |
| E. Feliciana .....   | 418.00        | .....       | .....         | .....       |
| Evangeline .....     | 515.00        | 150.00      | 358.50        | .....       |
| Franklin .....       | 1,187.00      | .....       | 754.00        | .....       |
| Grant .....          | 1,032.00      | .....       | 383.00        | .....       |
| Iberia .....         | 1,988.50      | 50.00       | 1,040.50      | .....       |
| Iberville .....      | 4,835.00      | 50.00       | 824.00        | .....       |
| Jackson .....        | 326.00        | .....       | 786.00        | .....       |
| Jefferson .....      | 272.50        | 50.00       | 125.00        | .....       |
| Jeff. Davis .....    | 727.00        | .....       | 596.00        | .....       |
| Lafayette .....      | 541.00        | 140.00      | 500.00        | 340.00      |
| Lafourche .....      | 293.00        | 160.00      | .....         | 100.00      |
| LaSalle .....        | 529.00        | .....       | 326.00        | .....       |
| Lincoln .....        | .....         | .....       | .....         | .....       |
| Livingston .....     | 1,245.00      | .....       | 42.00         | .....       |
| Madison .....        | 4,018.00      | .....       | 1,660.00      | .....       |
| Morehouse .....      | 2,247.00      | .....       | 1,380.50      | 200.00      |
| Natchitoches .....   | 805.00        | .....       | 1,575.00      | .....       |
| Orleans .....        | 1,155.00      | .....       | .....         | 1,350.00    |
| Ouachita .....       | 856.00        | .....       | 310.50        | 400.00      |
| Plaquemines .....    | 1,625.00      | .....       | .....         | .....       |
| Pt. Coupee .....     | 1,935.50      | .....       | 684.00        | .....       |
| Rapides .....        | 1,259.00      | 100.00      | 250.00        | 450.00      |
| Red River .....      | 1,054.00      | 100.00      | 112.00        | .....       |
| Richland .....       | 1,723.00      | .....       | 480.00        | .....       |
| Sabine .....         | 754.00        | .....       | 1,492.00      | .....       |
| St. Bernard .....    | 100.00        | 75.00       | .....         | .....       |
| St. Charles .....    | 280.50        | .....       | 550.00        | 550.00      |
| St. Helena .....     | 432.00        | .....       | 443.50        | .....       |
| St. James .....      | 194.00        | .....       | .....         | .....       |
| St. John .....       | .....         | .....       | .....         | .....       |
| St. Landry .....     | 2,361.50      | .....       | 685.00        | 67.50       |
| St. Martin .....     | 2,389.50      | .....       | 604.00        | 300.00      |
| St. Mary .....       | 427.50        | .....       | .....         | .....       |
| St. Tammany .....    | 840.00        | .....       | .....         | .....       |
| Tangipahoa .....     | 1,887.50      | .....       | 492.50        | .....       |
| Tensas .....         | 6,511.00      | .....       | 3,472.00      | .....       |
| Terrebonne .....     | .....         | 350.00      | .....         | .....       |
| Union .....          | 507.50        | 100.00      | 127.00        | .....       |
| Vermilion .....      | 2,376.00      | .....       | 150.00        | 535.00      |
| Vernon .....         | 2,483.00      | 240.00      | 480.00        | 275.00      |
| Washington .....     | 820.50        | .....       | 192.50        | .....       |
| Webster .....        | 1,189.50      | .....       | 235.00        | .....       |
| W. Baton Rouge ..... | 502.00        | .....       | 125.00        | .....       |
| W. Carroll .....     | 1,811.50      | .....       | 231.00        | 200.00      |
| W. Feliciana .....   | 386.00        | .....       | 100.00        | .....       |
| Winn .....           | 442.00        | .....       | 497.00        | .....       |
| TOTAL .....          | \$76,806.50   | \$ 3,155.00 | \$39,321.50   | \$ 9,122.50 |



Wildlife agents shown with shrimp seized during closed season.



Commission-owned Widgeon amphibious aircraft is utilized greatly in water pollution enforcement patrol. Oil slicks or spills are easily spotted from the air and this type of aircraft is ideally suited to land near the site of an obvious violation and allow agents to issue immediate citations.



Wildlife Agents Samuel J. Nunez, Richard Barney and Emile Perez are shown with wild ducks seized from violators. Violation of the provisions of the Migratory Bird Treaty is a federal offense. Ducks are kept in freezer as evidence until the case has been heard. Later they are donated to a charitable organization.

## FINES

|                           | 1968 | 1969 |
|---------------------------|------|------|
| Nol Prossed .....         | 853  | 227  |
| Not Guilty .....          | 12   | 14   |
| Decline Prosecution ..... | 68   | 10   |
| Cases Dismissed .....     | 271  | 126  |
| Fine Suspended .....      | 74   | 47   |
| Aquitted .....            | 12   | 18   |
| Probation .....           | 34   | 76   |
| Jail .....                | 40   | 29   |
| No Action by D.A. ....    | 398  | 15   |

## TYPES OF VIOLATIONS

### Sport Fishing

|                                       |       |       |
|---------------------------------------|-------|-------|
| Taking fish with pistol .....         | ....  | 4     |
| Fishing w/o a lic. ....               | 1,816 | 1,422 |
| Fishing w/o a non-resident lic. ....  | 27    | 23    |
| Shocking fish .....                   | 5     | 14    |
| Selling fish .....                    | 1     | 1     |
| Illegal tackle .....                  | 5     | 3     |
| Undersize fish .....                  | 0     | 1     |
| Over limit of fish .....              | 17    | 12    |
| Fishing in Lacassine Refuge .....     | 2     | ....  |
| Taking game fish with comm. nets .... | 5     | 35    |
| Using hoop nets in closed area .....  | 1     | 0     |
| Selling oysters—no lic. ....          | 2     | 0     |
| Taking oysters on Natural reef .....  | 3     | 0     |
| Aiding in selling of game fish .....  | 1     | 0     |
| Using trammel nets—no tags .....      | 1     | 3     |
| Transporting game fish .....          | 0     | 4     |
| Poss. over limit of game fish .....   | 0     | 7     |

### State Hunting

|                                        |      |     |
|----------------------------------------|------|-----|
| Hunting rabbits on GMA (Closed) ....   | 0    | 9   |
| Hunting rabbits w/o lic. ....          | 57   | 37  |
| Hunting rabbits in closed season ..... | 45   | 37  |
| Overlimit of rabbits .....             | 2    | 2   |
| Poss. of rabbits illegal .....         | 1    | 29  |
| Hunting rabbits at night .....         | 576  | 509 |
| Hunting rabbits non-resident lic. .... | 0    | 1   |
| Hunting squirrel w/o a lic. ....       | 46   | 48  |
| Hunting squirrel in close season ..... | 112  | 152 |
| Overlimit of squirrel .....            | 5    | 4   |
| Poss. of squirrel illegal .....        | 1    | 0   |
| Hunting squirrel at night .....        | 2    | 3   |
| Hunting squirrel on GMA (closed) ....  | .... | 1   |
| Hunting with unplugged gun .....       | 40   | 36  |
| Hunting on road or hwy. ....           | 97   | 111 |
| Hunting from vehicle .....             | 0    | 3   |
| Hunting quail in closed season .....   | 14   | 13  |
| Hunting quail w/o a lic. ....          | 2    | 8   |
| Hunting on state park .....            | 4    | 0   |
| Hunting deer from a boat .....         | 1    | 1   |
| Hunting deer w/o a big game lic ....   | 20   | 23  |
| Hunting deer w/o a lic. ....           | 13   | 25  |
| Hunting deer in closed season .....    | 191  | 111 |
| Hunting deer in closed area .....      | 26   | 29  |
| Hunting deer with unplugged gun ....   | 16   | 5   |
| Untagged deer .....                    | 23   | 13  |
| Hunting deer w/o permit .....          | 15   | 7   |
| Hunting deer on GMA illegal .....      | 18   | 1   |
| Hunting deer at night .....            | 156  | 155 |
| Hunting deer w/dogs—still season ....  | 4    | 7   |
| Possession of doe deer .....           | 97   | 43  |
| Possession of deer—buck illegal .....  | 38   | 12  |
| Hunting deer in flooded area .....     | 0    | 0   |
| Poss. of gun while bow hunting .....   | 1    | 2   |
| Shooting deer off road or hwy. ....    | 86   | 58  |
| Hunting deer—no tags .....             | 27   | 18  |
| Poss.—illegal deer meat .....          | 1    | 1   |
| Hunting with dogs on GMA .....         | 6    | 42  |
| Hunting deer—non-resident lic. ....    | 0    | 3   |
| Possession of illegal deer .....       | 0    | 66  |
| Offering deer for sale .....           | 0    | 3   |
| Poss. over limit of deer .....         | 0    | 2   |

## Miscellaneous Hunting

|                                          | 1968 | 1969 |
|------------------------------------------|------|------|
| Possession of Ibis—no open season ....   | 6    | 22   |
| Hunting w/o a resident lic .....         | 23   | 50   |
| Firehunting .....                        | 83   | .... |
| Hunting w/o license .....                | 67   | .... |
| Hunting on State Game Preserve .....     | 139  | .... |
| Hunting turkey w/o a lic .....           | 4    | 1    |
| Hunting turkey in closed season .....    | 8    | 4    |
| Hunting turkey—no tags .....             | 3    | 1    |
| Hunting turkey with illegal gun .....    | 1    | .... |
| Hunting coon alone .....                 | .... | 2    |
| Hunting coon in powered boat .....       | .... | 4    |
| Hunting frogs in closed season .....     | 35   | 47   |
| Possession of firearms while frogging .. | 5    | 8    |
| Selling frogs—no license .....           | .... | 1    |
| Hunting coon from a boat .....           | 2    | .... |
| Selling coon w/o a license .....         | 7    | 1    |
| Hunting coon with a shotgun .....        | 16   | 4    |
| Hunting coon w/o dogs .....              | 3    | 10   |
| Hunting coon on roadway .....            | .... | 3    |
| Hunting alligators in close season ....  | 28   | 15   |
| Undersize alligators .....               | 17   | 5    |
| Possession of alligators or skins .....  | 10   | .... |
| Shipping alligators—no tags .....        | 2    | .... |
| No record of skins .....                 | 1    | .... |
| Failure to visit traps daily .....       | .... | 1    |
| Trapping w/o a lic. ....                 | 6    | 10   |
| Trapping in close season .....           | 2    | 6    |
| Taking nutria at night with light & gun  | 6    | 14   |
| Taking mink in closed season .....       | .... | 2    |
| Hunting F.B.A. at night                  | .... | .... |
| with light & gun .....                   | .... | 85   |
| Trapping in closed season .....          | .... | 1    |

## Motorboat

|                                         |       |     |
|-----------------------------------------|-------|-----|
| Unregistered boat .....                 | 319   | 90  |
| No numbers on boat .....                | 73    | 61  |
| Expired registration .....              | 40    | 11  |
| No life jackets .....                   | 1,265 | 920 |
| No running lights .....                 | 110   | 53  |
| Water skiing w/one operator .....       | 46    | 50  |
| Reckless operation of motorboat .....   | 17    | 9   |
| No title or transfer papers .....       | 12    | 245 |
| No fire extinguisher .....              | 4     | 0   |
| Improper numbers on boat .....          | 1     | 0   |
| Using over size motor on rented boat .. | 2     | 0   |
| Possession of stolen outboard tanks ..  | ....  | 2   |
| Possession of stolen outboard motor ..  | ....  | 2   |

## Trawling

|                                 |    |      |
|---------------------------------|----|------|
| Trawling w/o a lic. ....        | 29 | 20   |
| Trawling in close season .....  | 60 | 68   |
| Trawling in close area .....    | 10 | 9    |
| Illegal butterfly nets .....    | 1  | 1    |
| Improper size mesh .....        | 3  | 4    |
| Selling shrimp no license ..... | 2  | .... |

## Commercial Fishing

|                                      |    |    |
|--------------------------------------|----|----|
| Possession crabs—berry stage .....   | 0  | 3  |
| Possession undersize oysters .....   | 0  | 3  |
| Fishing w/o a license .....          | 85 | 45 |
| Selling fish w/o a lic. ....         | 15 | 12 |
| Fishing w/o a non-resident lic. .... | 1  | 0  |
| Undersize fish .....                 | 51 | 44 |
| Undersize crabs .....                | 4  | 0  |
| Seine in close area .....            | 0  | 0  |
| Selling & poss. of game fish .....   | 44 | 0  |
| Blocking passage with seine .....    | 22 | 20 |
| Illegal size mesh .....              | 15 | 14 |
| Untagged hoop nets .....             | 8  | 8  |
| Using illegal tackle .....           | 30 | 22 |
| Shocking fish .....                  | 6  | 14 |
| Poss. undersize shrimp .....         | 0  | 56 |
| Using fish traps .....               | 0  | 25 |
| Untagged trammel nets .....          | 0  | 3  |
| Untagged gill nets .....             | 0  | 5  |
| Buying game fish .....               | 0  | 8  |
| Taking game fish with dip nets ..... | 0  | 3  |
| Poss. of exotic fish .....           | 0  | 1  |
| Using gill nets—closed area .....    | 0  | 5  |

## Federal

|                                           | 1968 | 1969 |
|-------------------------------------------|------|------|
| Hunting teal—illegal hours .....          | 0    | 7    |
| Poss. over limit teal .....               | .... | 30   |
| Hunting teal unplugged gun .....          | 2    | 0    |
| Hunting teal in close season .....        | 2    | 0    |
| Hunting teal—no license .....             | 0    | 2    |
| Killing snipe in close season .....       | 10   | 3    |
| Cedar Wax Wings in possession .....       | 2    | 7    |
| Possession of Heron .....                 | 0    | 0    |
| Hunting doves w/o a lic. ....             | 63   | 15   |
| Hunting doves illegal hours .....         | 4    | 4    |
| Over limit of doves .....                 | 1    | 2    |
| Hunting doves in closed season .....      | 18   | 16   |
| Hunting doves with unplugged gun ...      | 14   | 3    |
| Hunting doves over a baited area ....     | 42   | 0    |
| Taking illegal type ducks .....           | 0    | 43   |
| Possession of grobec .....                | 2    | 0    |
| Possession of freshly killed grosbec ...  | 13   | 10   |
| Possession of freshly killed rail .....   | 0    | 1    |
| Hunting coots w/o a license .....         | 6    | 1    |
| Hunting coots in closed season .....      | 11   | 7    |
| Possession over limit of coots .....      | 0    | 5    |
| Hunting over baited area .....            | 11   | 39   |
| Hunting ducks w/o a license .....         | 14   | 37   |
| Hunting ducks unplugged gun .....         | 13   | 32   |
| Hunting ducks w/o a federal stamp ...     | 47   | 69   |
| Hunting ducks illegal hours .....         | 55   | 126  |
| Hunting ducks in close season .....       | 82   | 94   |
| Hunting ducks with live decoys .....      | 3    | 1    |
| Overlimit of ducks .....                  | 58   | 211  |
| Hunting ducks from running power boat     | 22   | 46   |
| No signature on stamp .....               | 6    | 21   |
| Possession of completely dressed birds .. | 5    | 0    |
| Poss. of untagged ducks .....             | 0    | 1    |
| Hunting geese w/o lic. ....               | 1    | 0    |
| Hunting geese unplugged gun .....         | 0    | 0    |
| Hunting geese w/o a federal stamp ...     | 6    | 1    |
| Hunting geese illegal hours .....         | 6    | 0    |
| Hunting geese in close season .....       | 3    | 12   |
| Overlimit of geese .....                  | 4    | 0    |
| Selling wild ducks .....                  | 2    | 0    |
| Failure to kill crippled geese .....      | 2    | 0    |
| Hunting ducks from a moving vehicle..     | 2    | 0    |
| Taking woodcock at night .....            | 0    | 4    |
| Wanton waste of birds .....               | 0    | 7    |

## Miscellaneous

|                                         |    |    |
|-----------------------------------------|----|----|
| Organized Drive on GMA .....            | 0  | 26 |
| Disturbing the peace .....              | 2  | 5  |
| Criminal trespass .....                 | 0  | 5  |
| Simple assault .....                    | 3  | 2  |
| Possession of concealed weapon .....    | 4  | 0  |
| Interfering with an officer .....       | 6  | 0  |
| Resisting arrest .....                  | 28 | 16 |
| Hunting on refuge—no permit .....       | 8  | 0  |
| Killing song birds .....                | 1  | 1  |
| Possession of firearms on GMA .....     | 30 | 0  |
| Possession of illegal shotgun .....     | 1  | 2  |
| Trespassing on refuge at night .....    | 5  | 8  |
| Hunting at night illegally .....        | 3  | 26 |
| Taking herons in close season .....     | 6  | 0  |
| Discharging firearms from boat .....    | 2  | 0  |
| Discharging firearms from road .....    | 46 | 76 |
| Taking coon illegally .....             | 5  | 0  |
| Hunting restricted area .....           | 7  | 9  |
| Trespassing on Sabine Mgr. Area ....    | 16 | 0  |
| Attempted theft of OB motor .....       | 1  | 0  |
| Speeding on Highway .....               | 3  | 0  |
| Failure to post bond .....              | 5  | 0  |
| Hunting deer from moving vehicle ...    | 3  | 4  |
| Taking woodpecker—no open season ...    | 2  | 0  |
| Trespassing on GMA .....                | 39 | 12 |
| Taking deer by helicopter .....         | 1  | 0  |
| Shooting at Wild Life signs .....       | 0  | 1  |
| Hunting doves—moving vehicle .....      | 2  | 0  |
| Trespassing on Hunting club .....       | 2  | 0  |
| Training rabbit dogs illegally .....    | 1  | 0  |
| Driving under influence of liquor ..... | 1  | 0  |
| Hunting on GMA—no permit .....          | 6  | 0  |
| Criminal damage to state vehicle .....  | 1  | 0  |
| Hunting bear—no open season .....       | 0  | 3  |
| Hunting from moving vehicle .....       | 0  | 3  |
| Training dogs with firearms .....       | 0  | 1  |
| Failure to post bond .....              | 0  | 12 |

## Federal Miscellaneous

|                                      |    |    |
|--------------------------------------|----|----|
| Hunting with an unplugged gun .....  | 5  | 0  |
| Hunting robins in close season ..... | 12 | 15 |
| Hunting w/o a non-resident lic. .... | 1  | 0  |
| Taking kildeer—no open season .....  | 0  | 3  |

## Pollution

|                          |       |
|--------------------------|-------|
| Pollution of water ..... | 224   |
| TOTAL .....              | 6,600 |



Agents receiving new 17 ft. Glassmaster hull equipped with 115 hp Johnson motors, used for Enforcement work.



Agents patrolling in new Glassmaster hull equipped with 115 hp motors.

# Pollution Enforcement Section

The Pollution Enforcement Section, an arm of the Enforcement Division, was created August 1, 1969, in order to broaden the scope of Commission enforcement of existing pollution laws. Basic concept of the special section was to select personnel from the Enforcement Division and properly train and equip them to augment pollution enforcement work.

Essentially, the men detailed to this pollution enforcement work continue to carry out routine enforcement duties but at the same time are alert



**Capt. A. L. Prechac is in charge of the special Water Pollution Enforcement Section of the Commission's Enforcement Division. He is shown inspecting an oil field operation for possible violation of state pollution laws.**

to violations of pollution laws and trained to recognize them in the field while performing their regular duties.

The Section consists of 13 teams of wildlife agents from the eight districts of the Commission. Each team is equipped with color Polaroid cameras and versed in existing laws governing pollution.

One vessel, the Pelican, is assigned to the Section as a patrol boat. It was stationed at Morgan City during the biennium covered and made continuous pollution patrols in both coastal and inland waters.

In addition to the teams assigned to pollution enforcement duties, each team is equipped with small patrol boats and two-way radios, Commission aircraft were also used in this work. A minimum of two flights were made each week. Radio contact was maintained between aircraft and surface vessels.

During the five-month period in which the



**Agents of the Pollution Enforcement Section of the Enforcement Division are shown inspecting an oil field production barge. On-the-spot inspections result in immediate citations against offenders, greatly cutting down on field violations resulting from carelessness or faulty equipment.**

Section was operative, a total of 206 citations were issued. Individuals charged under Section 56, Title 362, were given 10 days in which to reply to specific charges. In most cases, replies were immediately forthcoming and those conditions resulting in pollution were corrected. There were 18 citations that failed to produce written replies within the 10-day period granted. Charges were filed against those individuals or companies in State Courts. Four arrests were made by agents assigned to this Section.

Capt. Alfred L. Prechac, Jr., is in charge of the Pollution Enforcement Section. Thomas L. Bradley, biologist with the Water Pollution Control Division, serves as coordinator between the special enforcement section and that division.



**Agents of the Pollution Enforcement Section of the Commission's Enforcement Division make continuous inspection of petroleum production and drilling operations. Violations of state pollution laws result in on-the-spot citations to offenders.**







